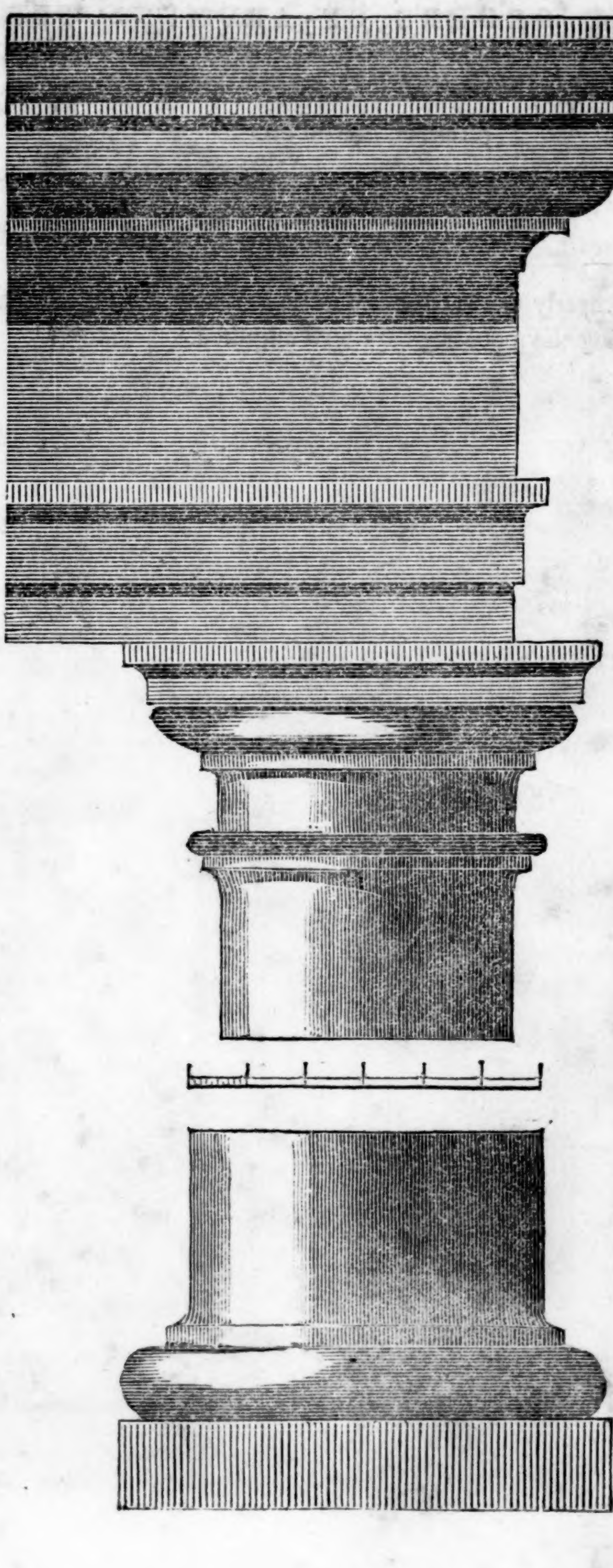
MECHANICS' MAGAZINE,

AND

JOURNAL OF THE MECHANICS' INSTITUTE.

VOLUME VII.—No. 4.] APRIL, 1833. [WHOLE NUMBER, 40.



THE STUDENT'S INSTRUCTOR

IN DRAWING AND WORKING

THE FIVE ORDERS OF ARCHITECTURE.

BY PETER NICHOLSON, ARCHITECT.

(Continued from our last.)

PLATE X.

The Tuscan Order properly shaded is given as an example, after the manner of setting out the parts and striking the mouldings are well acquired.

TUSCAN.

Fig. 1. Fig. 2.

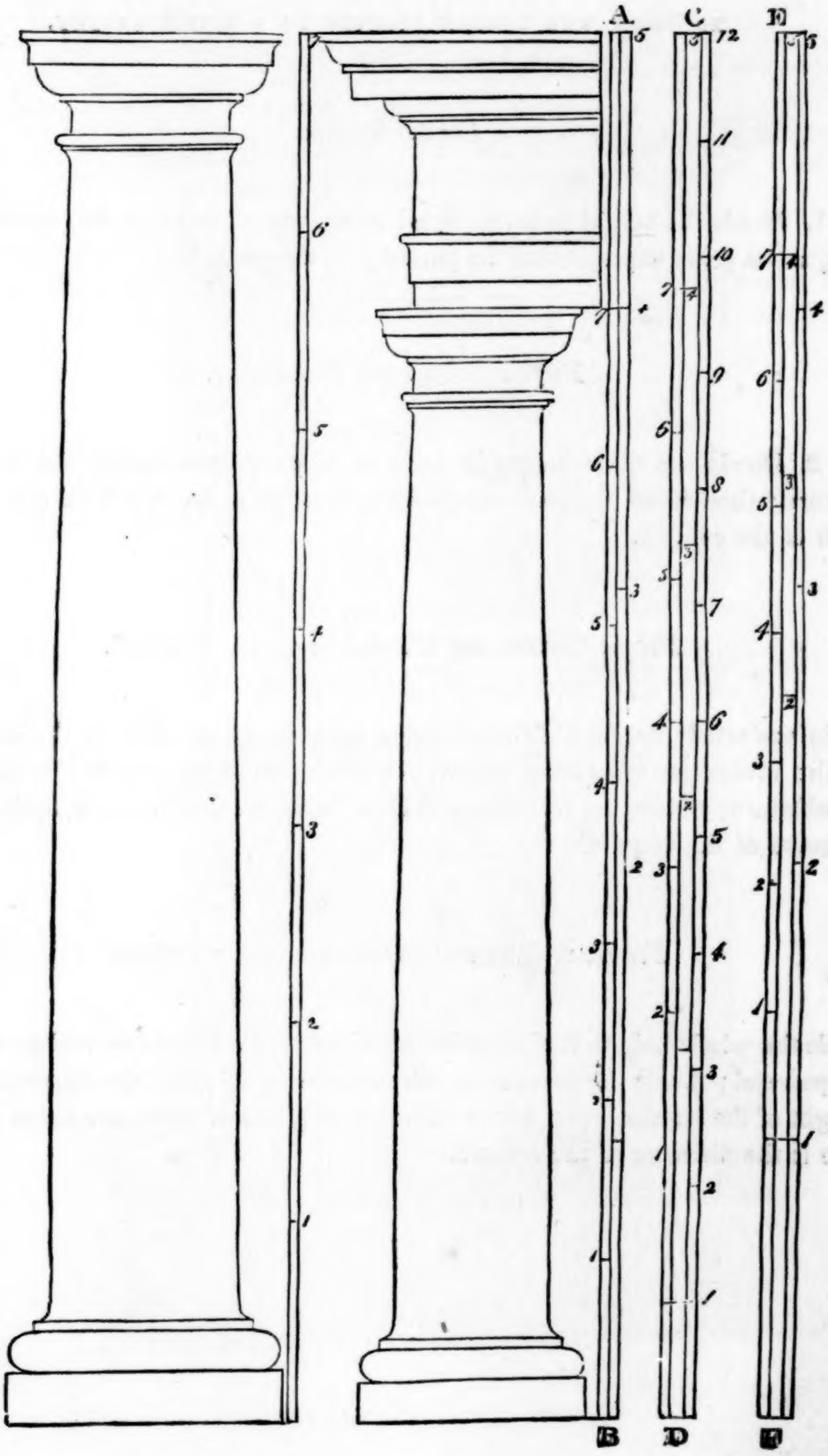


PLATE XI.

TO DRAW THE TUSCAN COLUMN TO A GIVEN HEIGHT.

For the Column.

Fig. 1. Divide the height in seven equal parts, one of these is the diameter of the column, and a scale to proportion the parts by. See page 38.

For the Column and Entablature.

Fig. 2. Divide the given height into five equal parts, give one for the height of the entablature; then divide the remaining four into seven parts, of which one will be the diameter of the column.

For the Column and Entablature upon a Subplinth.

Divide the whole height C D into twelve equal parts, one will be the height of the subplinth; divide the remaining eleven into five equal parts, one will be the height of the entablature; divide the remaining four of these parts into seven, and one will be the diameter of the column.

For the Column and Entablature upon a Pedestal.

Divide the whole height E F into five equal parts, the lower one will give the height of the pedestal; divide the remaining four into five equal parts, the upper one will give the height of the entablature; divide the remaining four of these into seven equal parts, and one is the diameter of the column.

A FINISHED BASE AND CAPITAL FOR A PILASTER.

Plate 12.

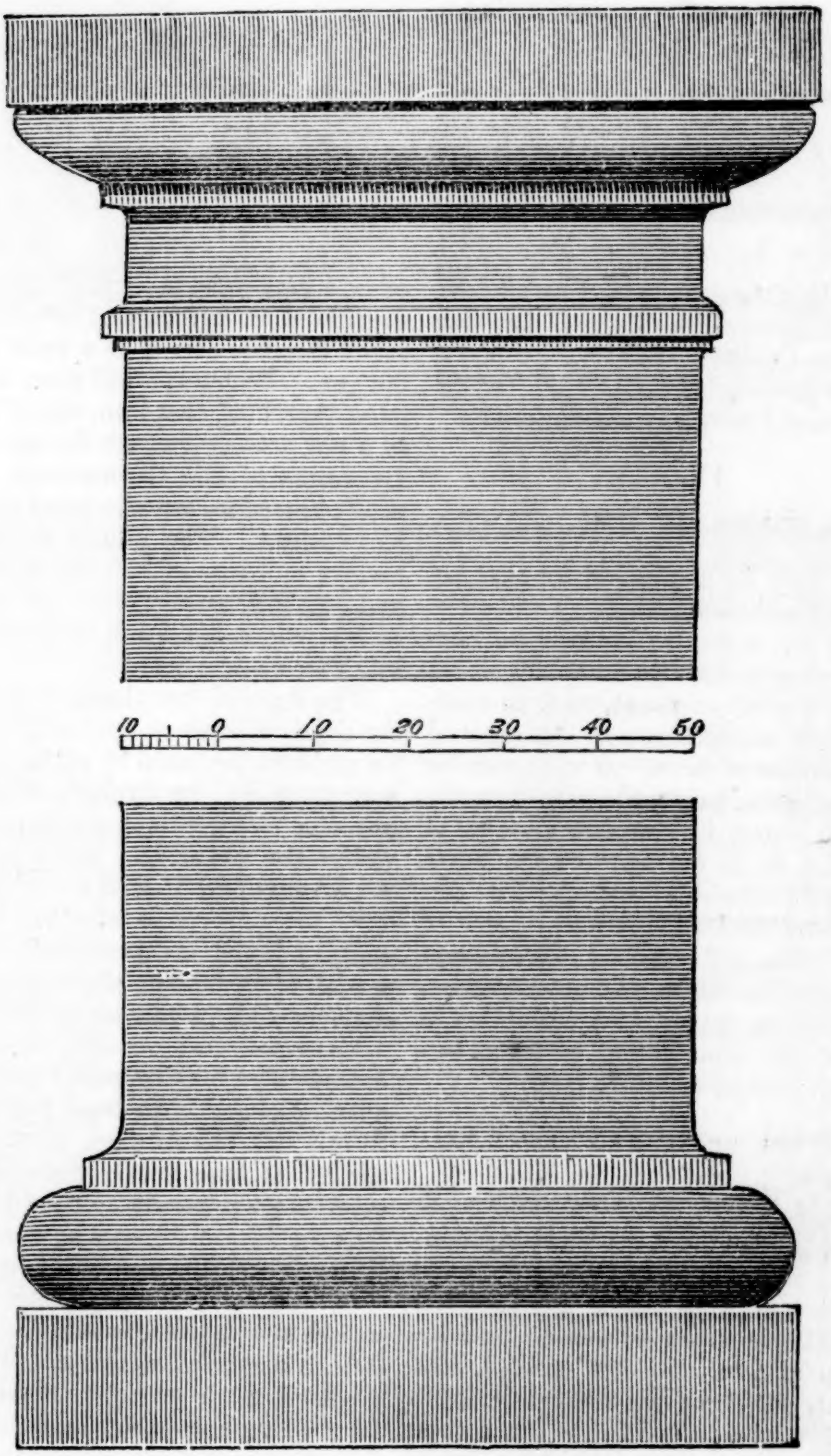


PLATE XII.

Is a Tuscan base and capital for a pilaster: the scale will show the proportions of the parts.

Applications of Chemistry to the Useful Arts, being the substance of a Course of Lectures delivered in Columbia College, New-York, by James Renwick, Professor of Natural Experimental Philosophy and Chemistry.

IV.

APPLICATIONS OF CHLORINE.

Chlorine may be applied in its gaseous form, as obtained in the mode practised in laboratories by action of manganese (*peroxide of manganese*) upon muriatic acid; or by the action of sulphuric acid on common salt and manganese; or as evolved from the chloride of lime. It may also be applied in solution, prepared by passing the gas through water, by steeping chloride of lime in water, or in the form of the liquor of Labaraque (*chloride of soda.*) The use of chloride of lime in both cases, and of chloride of soda in the second, have superseded the other methods. In consequence, before explaining the uses of chlorine it is proper that the manufacture of these two preparations should be understood.

MANUFACTURE OF CHLORIDE OF LIME.

AUTHORITY.—DUMAS. Chimie appliquee aux arts.

Chloride of lime in a dry form is manufactured in an apparatus invented by an English chemist, from whom the article is often called Tennant's bleaching powder. It consists of a retort or still of lead, connected by a pipe with a brick chamber cemented by a lute, which is not acted upon by chlorine. The still is heated by steam introduced into an envelope or *jacket* of cast iron. In the top of the still are two openings: one furnished with a stopper by which it is charged with manganese; to the other a bent tube is applied for the introduction of the acid, a part of which remaining in the tube serves as a valve to confine the gas. Within the still there is a reticulated vessel of cast iron, which is attached to a rod passing through the top of the still. By means of this the materials are continually stirred in, order to bring new surfaces into contact. The still is so large as to receive a charge of 200 lbs. of manganese, and four are usually employed at once, for which reason the brick chamber is divided into four compartments..

The floor of the chamber is covered to the depth of three or four inches, with powdered lime, prepared by slaking. In some manufactories the hydrate of lime is disposed in wooden trays resting upon shelves within the chamber. Only half of these are filled at first. At the expiration of two days, the process is stopped, the chamber ventilated, and the remainder of the trays are introduced, being placed on the alternate shelves. The gas being again admitted, the process goes on for two days more, when the first set of trays are removed and replaced by others charged with fresh hydrate of lime. In this way the chamber always contains a portion of lime nearly saturated, and another portion nearly free of chlorine, and thus the decreasing rate at which hydrate of lime absorbs chlorine is compensated.

A still better mode, which is employed in a few instances, would be to keep the lime in a state of agitation. This has been objected to on account of the expense of the moving power, but in an establishment furnished with a steam engine, this would be of little importance.

The apparatus most generally used will be understood by reference to the annexed plate.

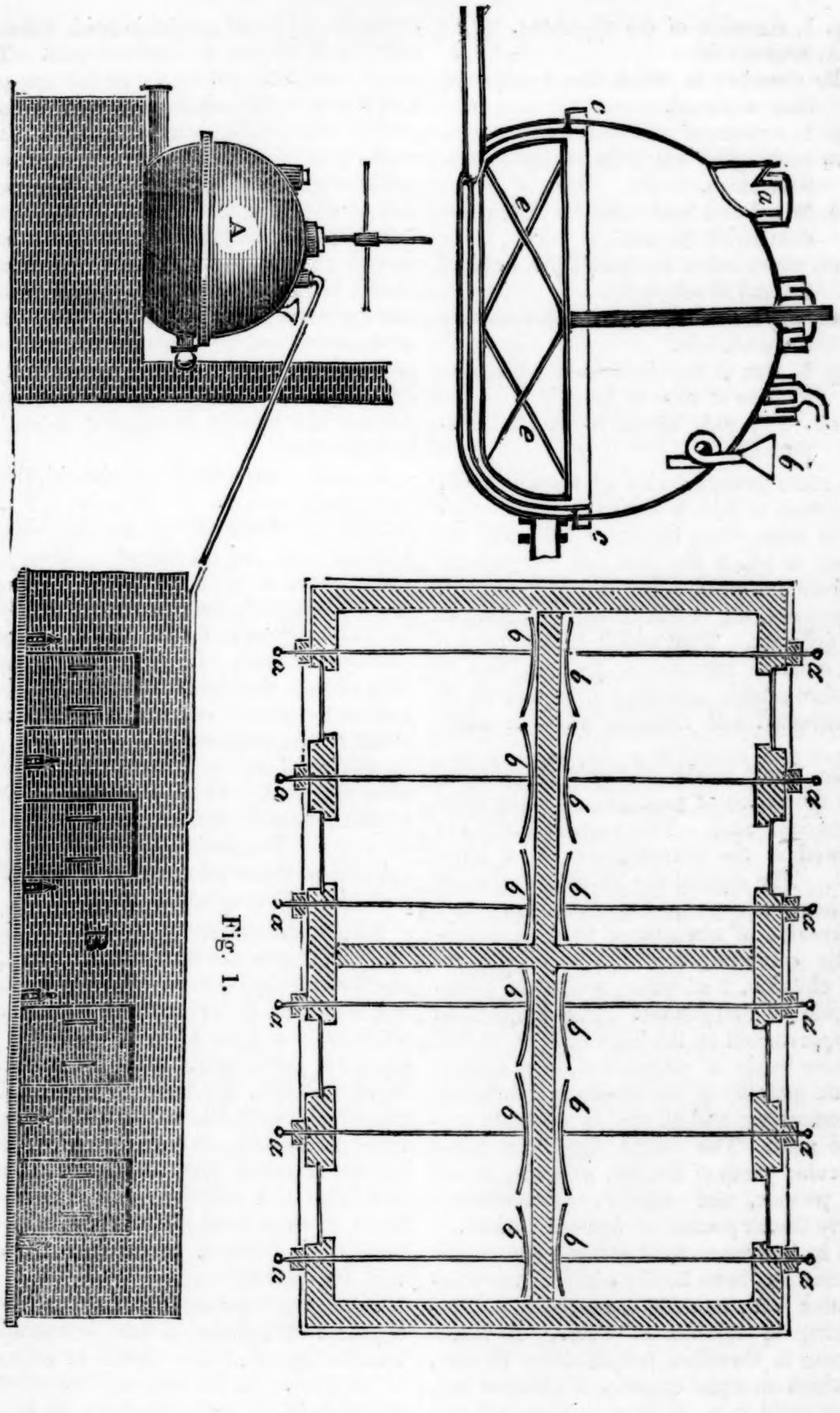


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1, elevation of the apparatus.
A, leaden still.
B, chamber in which the hydrate of lime is placed.
Fig. 2, section of still on a larger scale.
a, opening by which the manganese is introdoced.
b, funnel and bent tube for the introduction of the acid.
cc, water valve by which the head of the still is adapted.
ee, apparatus of cast iron for stirring the materials.
Fig. 3, plan of the chamber in which the hydrate of lime is placed.
aa, iron rods which move the scrapers *bb*.

In some manufactories on a small scale, the hydrate of lime is placed in conical vessels of stone ware, having a hole near the bottom, to which the pipe that conveys the gas from the retort is luted. At the end of the process, the vessel is inverted, and the lime falls out. That which is not charged with chlorine remains in powder, and is therefore readily separated from that which is converted into chloride, which is adhesive.

The direct mode of obtaining chlorine, is by the action of peroxide of manganese on muriatic acid. This may, and is often, followed in the manufacture on a large scale. The equivalents of the substances which are employed in the laboratory, are, 1 of peroxide of manganese to 4 of hydrochloric (muriatic) acid. The results are 2 of chlorine, 2 of water, and 1 of protochloride of manganese. The proportions are approached on the large scale by 6½ lbs. of pure oxide of magnanese, or a proportionate quantity of the common manganese of commerce, and 40 lbs. of common muriatic acid. The result should be about two cubic yards of the gas, weighing nearly ten pounds, and capable of saturating nearly fifteen pounds of hydrate of lime.

It is, however, obvious that a part of the chlorine has been lost by entering into combination with metallic manganese, and remaining in solution in water. A better process is therefore proposed by Dumas, by which an equal quantity of chlorine may be obtained at a far less expense of acid from a given quantity of common manganese. His formula is 10 or 12 lbs. of common manganese, equivalent to 6 1-2 of the peroxide, 4 lbs. of sulphuric acid, 4 lbs. of water, and 20 lbs. of muriatic acid. The retort being first charged with the manganese, the water is introduced, then the sulphuric, and finally the muriatic acid. The mixture of the water and sulphuric acid produce sufficient heat to cause the separation of the chlorine. No more fuel, therefore, need be used than is sufficient to keep up this temperature. In addition, the mixture is less likely to rise in viscid bubbles, and the chlorine is more free from water, as the attraction of the sulphuric acid will prevent that liquid from boiling until all the chlorine is disengaged. Sulphate of manganese will remain in solution instead of the chloride.

In some cases, however, the chloride of manganese may be of value, as it is used in dyeing. Here of course the existing process is to be preferred. When the manufacture of artificial soda is not a profitable object of industry, muriatic acid may be too expensive for the manufacture of chloride of lime. In this case, the materials whence that acid is obtainod (sulphuric acid and common salt,) may be used in its stead. The proportions in which they may be employed are, to 10 or 12 lbs. of common manganese, 12 of common salt, 20 of sulphuric acid, diluted with an equal quantity of water. The residuum of the retort is a solution of the sulphates of soda and of the protoxide of manganese.

A liquid mixture of lime and water (milk of lime) will condense 60 per cent. more chlorine than the dry hydrate. This preparation is not readily portable, but when the consumer manufactures it for himself, might be employed to great advantage. To make this liquid chloride, the milk of lime has been placed in a cylindric vessel of stone ware, lying horizontally, through the ends of which an axle is passed that carries a set of arms like those of a barrel-churn. The use of these is to agitate the mixture, and thus bring fresh surfaces of chlorine in contact with the chlorine.

From what has been stated above, it would appear that hydrate of lime is capable of condensing about two thirds of its weight of chlorine. In the ordinary manufacture, this strength is rarely reached, and the article may also be injured by exposure. It is therefore important that some mode should be pointed out by which the actual quantity

of chlorine condensed by the lime should be ascertained. No ready method fitted for the use of practical men has yet been proposed, by which this object can be effected with certainty. The method in common use is rather relative than absolute, and consists in inquiring into the quantity of the solution of indigo in sulphuric acid, the solution of a given quantity of chloride of lime is capable of discoloring. This method will give different results, both from the different qualities of indigo and different modes of manipulation. But by using the same solution of indigo, and operating in exactly the same manner, the comparative value in reference to a standard parcel of chlorine of lime is capable of being ascertained with tolerable accuracy.

PREPARATION OF THE SOLUTION OF CHLORIDE OF SODA OR LIQUOR OF LABARAQUE.

The works on elementary chemistry give the mode proposed by Labaraque himself, for forming this liquor, by passing chlorine in its gaseous form through a solution of sub-carbonate of soda. It is therefore unnecessary to repeat it here. It may, however, be stated that the value of the liquor is not increased by saturating the water with chlorine, but that it is in its best state when the chlorine is condensed in the largest quantity which can exist without causing the escape of the carbonic acid; and it is usually inferred that the chlorine, decomposing a part of the sub-carbonate, causes its acid to unite with the remaining soda to form the neutral carbonate of soda. If the quantity of chlorine exceed this proportion, which is of course just half of what might be condensed, muriatic acid will form in the solution, and chloride of sodium will be the final result.

The most convenient process for the preparation of chloride of soda on the large scale, is that invented by Payen, in which the chloride of lime is decomposed by sub-carbonate of soda. The proportions in his formula are: 100 parts chloride of lime, 188 of crystalized sub-carbonate of soda, and 1800 of water. The chloride of lime being dissolved, and the solid residuum washed, the sub-carbonate of soda dissolved in boiling water is added; the liquor is filtered, and to the clear liquor 62 parts of crystalized sub-carbonate of soda is added,

1. DISINFECTING.

Rationale.—Chlorine owes its powers of destroying the offensive effluvia of putrescent animal and vegetable substances, and of rendering innocuous the matters which convey the contagion of infectious diseases, to its powerful affinity for hydrogen. The gases which arise from putrescent animal matter are principally ammonia (a hydroguret of nitrogen) and carburets of hydrogen; and although they are not the substances which affect our nerves most offensively, they are certainly the vehicles which convey those which do so to our organs of smell. The effluvia of decaying vegetables are principally composed of carburetted hydrogen, and although our senses cannot detect any other substance, yet there can be no question that the gas so produced does convey a matter injurious to the human constitution, for while the *gas* manufactured for illumination may be breathed, even in quantities sufficient to render the air highly offensive, without injury, the same gas evolved from marshes and stagnant waters is always unwholsome. The diseased animal matter which composes the virus of cutaneous diseases, such as small pox, and collects in the sores of the plague, is also composed partly of hydrogen, and therefore capable of decomposition by chlorine. These peccant substances being capable of forming vapor, may thus be conveyed through the air, but in this state also, chlorine will act upon them.

Chlorine is destructive of animal life, and even when largely diluted immediately kills small animals. Even then, if, as some have supposed, the malaria which causes yellow fever and other analogous diseases of less malignancy, is owing to the presence of animalculæ, chlorine may be applied to destroy them.

Application.—Chlorine may be applied in its gaseous form to the disinfection of the air. The gas may be prepared as it is needed, by the action of peroxide of manganese (common manganese of the shops) on muriatic acid. This action, however, need not be aided by heat, as when the gas is prepared for chemical experiments, inasmuch as the object is to produce a constant and steady current, instead of a sudden and copious supply. A bottle, furnished with a glass plate ground to lie

upon its neck, is well suited for this purpose, and may be made of various sizes, according to circumstances, there being a form so small and so conveniently arranged, that it may be carried in the pocket.

Chloride of lime may be decomposed, by the action of water. In order to obtain the gas, a portion of chloride of lime is put into a shallow basin and covered with water. As the evolution of the gas becomes feeble it may be rendered more rapid by adding a small quantity of acid. Sulphuric acid very much diluted may be employed, but it is better, particularly when it is used in families, to add common vinegar.

In disinfecting chambers and buildings, the doors and windows are to be closed, and the fumigation continued until the peculiar smell of chlorine can be perceived in every part, and remains permanently when its source is removed. In a sick room it will be expedient to continue the fumigation as long as the sick person remains in it, and for some hours after. All moist offensive matters should be sprinkled with the dry chloride, and dry matters covered with its solution.

A solution of chlorine may be prepared by steeping chloride of lime in water in the proportion of eight ounces to each gallon of water, and decanting it from the lime. This may be used for steeping the bedding and clothes of persons affected with contagious diseases, or to wet cloths in which putrescent matters may be wrapped; but the chloride of soda is a much more convenient and cleanly preparation. By the aid of it, human bodies far gone in putrefaction have been disinterred for examination; and by one or the other preparation, the disagreeable and often dangerous effects of animal and vegetable decomposition may be in a great measure prevented.

In cases where it may be necessary to touch persons affected with contagious diseases, the hands should be washed with one of the solutions, and this will be efficacious even after many minutes, unless the virulent matter have been introduced through a wound. By the use of these substances several diseases that have hitherto been scourges of the human race, have already been diminished in extent, and might, if all were prudent enough to employ them, be extinguished altogether.

To show their important value, a French physician in the Levant (Parisot) was able to inspire five other persons with confidence in the efficiency of chlorine; these were of varions ages and different constitutions. Six suits in which persons had died of the plague were purchased, steeped in solution of chloride of soda, and dried. Each person being furnished with a suit, wore it for several days. No one of the six took the disease, while, had there been no precaution, all former experience would have made it nearly certain that more than two thirds of them must have been infected, and a considerable proportion of these would have died.

In our own naval service, the only vessel in which yellow fever has occurred in the Gulf of Mexico, since fumigations with chlorine have been practised, was one where they were not employed; and in one of the Spanish expeditions against Mexico, several vessels loaded with soldiers and sailors, were exposed for months to the pestilential air of the Terras Callientes without a single case of fever occurring.

In fine, we cannot avoid expressing our conviction that it is impossible, that any disease truly contagious can be propagated in air so charged with chlorine that its peculiar smell is sensible, nor any malady arising from the presence of unwholsome vegetable and animal matter. It will of course be impossible to disinfect extensive districts by artificial means, but so long as a disorder is confined to a limited space, its further extension may be checked, and even a building in an infected district may be rendered safe to its inhabitants, provided they do not quit its walls, by the aid of chlorine.

Experiments seem to be wanting, whence we might judge whether chlorine is as efficient in checking the extension of cholera, as it certainly is in preventing the spreading of other diseases; the impression of medical men, however, is that it is not.

2. BLEACHING.

History.—The ancient progress of bleaching vegetable matters is the same as that employed for domestic purposes, with the addition of an agent to neutralize alkaline matter which might otherwise injure the vegetable fibre. The articles were repeatedly washed with alkaline leys, or with soap; they were then steeped in a weak acid; and, after being well rinsed in pure

water, were spread out on meadows in order to be exposed to the sun and air. In this position they were frequently sprinkled with water. The only water which is adapted to this purpose is that which in ordinary language is called soft. This is found in streams only at a distance from their source, and from a command of water of this description, as well as from the extent of its meadow lands, Holland for a long time monopolized the bleaching of the greater part of Europe. The linens of Ireland and Great Britain were sent thither to be bleached, and, as the process was a long one, it was seldom that the capital employed in the manufacture was turned more than once a year. The successive washing, and exposures to the air requiring to be repeated fourteen or fifteen times, and the latter being only practicable in fine weather. The acid used to neutralize the alkaline matter was sour milk, in which by fermentation acetic acid had been generated.

The first improvement in the process was the substitution of dilute sulphuric acid for the sour milk. Still, there was no great saving in time, until Berthollet in France proposed the application of the bleaching properties of chlorine. This substance was at first applied in its gaseous form to the articles, suspended while wet with water in close chambers. Its solution in water was next introduced. This has the defects of being difficult of carriage, and of becoming charged with muriatic acid by the decomposition of the water. In order to neutralize the acid as it forms, the water, was charged with a carbonated alkali or with magnesian earth. In the use of the former it was discovered that a chloride of the alkali was formed which would be decomposed by the coloring matter of the vegetable substance, and that in this liquid chloride, more of the chlorine was retained than in the same bulk of pure water.

This liquid chloride of Potassa has been much used under the name of liquor of Javelle.

The use of magnesia led to the discovery of the dry chloride of that earth, and it being found that a similar compound was formed with lime, the latter in consequence of its inferior cost finally superseded the former. By the use of chlorine in either mode, the process which formerly occupied several months, is now completed in a day or two.

Rationale.—Hemp, Flax, and Cotton, which are the only substances of vegetable origin that are much employed in the manufacture of cloths, are more or less colored with a brown or yellowish substance. This coloring matter is partly oleaginous, and partly resinous. The oleaginous matter is rendered soluble in water by an alkali; but as any excess of this would attack the vegetable fibre, it must be neutralized by an acid. The resinous part of the coloring matter, if moist, decomposes slowly on exposure to the sun and air; hence the ancient mode of bleaching. This resinous matter when no longer protected by the oil is rapidly decomposed by chlorine; hence the modern method.

(A) BLEACHING OF COTTON YARN BY CHLORINE.

AUTHORITY—VITALIS, Cours de Teinture.

First operation.—Alkaline Bath.—A quantity of good pearlash in powder is mixed with half its weight of recently slacked lime. To this is added water in the proportion of thirty times the weight of the potash. The mixture is occasionally stirred, and at the end of twenty-four hours is allowed to settle. The clear liquor is then decanted. The yarn to be bleached is thrown loosely into a copper boiler, and the alkaline solution poured upon it, until the upper part of the cotton is two or three inches beneath the surface of the liquid. The boiler is then slowly heated until the liquor boils, and the ebullition is kept up for four hours. At the end of this time the cotton is removed, and after being permitted to drain, is well rinsed in running water, after which the liquid is wrung out, and the yarn hung up to dry; in fine weather in the open air, and in bad weather under sheds.

Second operation.—Bath of Chlorine.—This bath is formed by steeping chloride of lime in water, in the proportion of eight ounces to each gallon; the insoluble matter is allowed to settle, and the liquor decanted. The yarn is placed in regular layers in a wooden vat, the hanks in the successive layers crossing each other. On these the clear solution of chloride of lime is poured until they are completely immersed, and the liquor rises above them three or four inches. The yarn having been steeped for a couple of hours, the liquid is drawn off by a spigot in the bottom of the vat, and is replaced by pure water, which being drawn off in its turn, carries with it the

chloride which may have adhered to the yarn. The yarn is then rinsed in running water, wrung and hung out to dry.

Third operation.—Acid Bath.—Sulphuric acid is diluted with sixty times its weight of water, and the yarn is steeped in it for a time not exceeding a single hour for the coarsest numbers and less for the finer yarn. On taking it from this bath, it must be repeatedly washed with great care in running water.

Fourth operation.—Soap Bath.—The yarn is washed with white soap in water for the purposes of neutralizing any sulphuric acid which may remain, of removing the last portions of chlorine, and of rendering the cotton soft and flexible. It is then rinsed, wrung, and dried.

In order to brighten the color, cotton is sometimes steeped after the four preceding operations in water, through which a small quantity of cobalt blue has been disseminated.

These operations are sufficient for the inferior qualities of cotton yarn. The finer kinds are immersed in an alkaline bath of greater strength; are twice passed through a bath of chloride of lime, that used the second time being weaker than the first; and cobalt blue is always employed to finish them.

Linen and hemp threads are bleached in the same manner as cotton yarn, but they must be prepared for the alkaline bath by steeping them for two or three days in water, by which the coloring matter is softened and made more accessible to the chemical agents. The methods for bleaching woven cloths of the three several materials are more difficult than are necessary for yarn, but do not differ in principle. It is only necessary, according to the firmness of the cloth, to repeat the processes in regular succession two or three times.

It may be remarked that bleaching by chlorine, if carefully performed, is, contrary to general prejudice, less likely to injure the texture of the material than grass bleaching. The latter, too, may be said to be wholly abandoned, so that the inscription upon foreign goods of "genuine grass bleach," is untrue, and were it true, would be no warrant of superiority in quality.

Chlorine does not act upon the native coloring matters of wool or silk, but as the modes for discharging them go under the same name, we may with propriety consider them in this place.

(B) BLEACHING OF SILK.

AUTHORITY.—VITALIS. Art de Teinture.

Silk is covered with a substance which has the character of a gum, and is usually of a color more or less inclining to yellow, although the finer raw silks of China are said to be perfectly white. Even in the latter case, the process which is used to discharge the color, is in some degree necessary to prepare the silk for receiving dyes.

Silk may be bleached either by the aid of sulphurous acid or without it.

To bleach it without the use of sulphurous acid, a bath is prepared by dissolving white soap in water, in the proportion of 30 parts to 100 of silk. The solution is raised to the boiling temperature, but not permitted to undergo the act of ebullition. The silk is steeped in this bath until the harshness given by the gum disappears, and is then wrung out and dried. It is next put into sacks made of coarse canvass, each of which holds about thirty pounds of silk. These sacks are put into a boiler with a weaker solution of white soap, which is boiled for an hour and a half. The silk is then taken out, rinsed in running water, and dried. The dry silk is finally steeped in a bath of hot but not boiling water, in which white soap in the proportion of a pound to 30 gallons of water has been dissolved. To this is added a small quantity of some coloring matter, which is anatto when the hue of Chinese silk is to be imitated, and cobalt blue in other cases.

This method is less perfect than that which brings in the aid of sulphurous acid, as a substitute for the last of the three baths above described. The silk, after being rinsed from the second bath of soap is suspended upon poles about 8 feet above the floor of a chamber, which has no chimney, and is provided with doors and window-shutters that can be opened and closed without entering the chamber. For every hundred pounds of silk a pound and a half of roll-brimstone is put into an earthen dish on the floor of the chamber, and set on fire: The doors and windows are then tightly closed. The sulphurous acid which is first generated by the combustion of the sulphur is condensed by the water adhering to the

silk, and after this is saturated, fills the chamber. The silk is left in this atmosphere of sulphurous acid for twenty four hours, after which the doors and windows are opened and the chamber ventillated. In summer the current of air which replaces the sulphurous acid is sufficient to dry the silk. In winter portable furnaces containing charcoal in small fragments are introducee into the chamber, and after they are set on fire the doors and windows are closed. In both cases, the combustion, whether of sulphur or charcoal is slow, as the necessary oxygen must make its way through the accidental crevices of the doors and windows.

In neither of the ways above described is the discoloration of the silk permanent. On exposure to the air in wear, the natural color of the silk is partially restored. It therefore becomes necessary to bleach white silks that are in wear, from time to time. This is done by suspending them, while wet, in a barrel, in the bottom of which a small quantity of sulphur is inflamed in an earthen vessel. The top of the barrel is then covered by a cloth, and the whole is left undisturbed for several hours.

BLEACHING OF WOOL.

Wool is coated with a greasy substance called the *Yelk*, with which a yellow coloring matter is combined. The coarser wools contain least of this substance, but in the finer merinoes it amounts to two thirds of the whole weight. The removal of this cannot be wholly effected by chemical means, but must be partially effected by the mechanical operation called fulling. This may be performed upon the wool, on yarn, or on the woven cloth. It consist in beating the article in a mill, with water and a mineral called Fuller's Earth, which is a silicate of alumina in which the silex is in greater proportion than in ordinary clays.

After having been fulled, the wool is washed in luke warm water, in which a small quantity of a soap is dissolved, until the residue of the yelk is removed. After being allowed to drain, it is rinsed in running water, permitted again to drain, and dried in the air.

This method is not successful unless the water is perfectly free from saline matter, or in ordinary language soft. In districts where large supplies of soft water cannot be obtained, it is considered necessary to mix the water used in cleansing wool with one fourth of its bulk of putrid urine. This supplies an ammoniacal salt, (phosphate of ammonia and soda,) by which the sulphate of lime, which gives to water the character know by the epithet *hard* is decomposed. In countries where the woolen manufacture is carried on extensively, this disgusting substance is in consequence a profitable article of commerce. There are however modes of rendering water soft, which we shall have occasion to describe hereafter, which might be advantagously introduced in the woolen manufacture.

From the Journal of the Franklin Institute.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. A. C. Jones' Spark Arrester.

The Committee on Science and the Arts, constituted by the Franklin Institute of th State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, an apparatus for stopping the sparks from the flues of locomotive engines, invented by Mr. Alfred C. Jones, of Portsmouth, Virginia, Report:—

That it has for some time been considered a desideratum to devise a plan by which the sparks escaping from the chimney, or smoke pipe, of a locomotive engine, may be arrested, so as to ensure both the comfort of passengers, and the safety of goods, transported on Railroads. The rapid extension of this mode of conveyance, is every day rendering this object of increased importance. Judging from the certificates of engineers and others, exhibited by Mr. Jones, it may be inferred that he has been more successful in relation to it, than preceding inventors.

The principal peculiarities of Mr. Jones' invention, are the following.

1. A projection, and funnel shaped opening, in the front part of the wire gauze, which surmounts the smoke pipe. This opening is for the purpose of admitting the external air to mix with the escaping smoke and steam, and is supposed to have the double effect of cooling and condensing the smoke and steam, so that it will not burn and destroy the wire gauze, and of producing a horizontal, or backward, current of air, which throws the sparks into the receptacle hereafter described.

2. A peculiar shape in the wire gauze cap, extending a considerable distance back ward, over or beyond the back of the top of the smoke pipe, which affords a space for

the sparks to be thrown down into the receptacle hereafter described, the shape of the back part of the cap, or wire gauze, being such that the sparks do not strike it perpendicularly, but obliquely to its surface, and thus are thrown down, instead of passing through the apertures.

3. A receptacle for sparks, back of the top of the smoke pipe, and under the back part of the gauze cap, at the lower part of which receptacle is a pipe, extending downward into the smoke chamber at the end of the boiler, and below the part immediately connected with the boiler. Through this pipe, the sparks pass, and fall into the bottom of the smoke chamber. It is supposed by Mr. Jones, that the impetus of the steam, escaping from the engine, through the smoke pipe, produces a partial vacuum in the bottom of the smoke chamber, and causes a portion of air to rush down the said pipe, which makes the sparks more readily descend, to a place where they are beyond the influence of the escaping current of smoke and steam, there to be consumed.

4. The gauze cap is made with hinge joints, so as to be thrown over backward, when the engine is not under way. This contrivance serves the double purpose of preventing the gauze from being clogged with lampblack, by the thick smoke escaping before the starting of the engine, and of facilitating the cleansing of the gauze, by a brush applied to its inner surface, where the smoke and lampblack condenses.

It is the opinion of the committee, that each of the foregoing features is productive of advantage. Hence, they are of opinion, that Mr. Jones' apparatus is among the best that has been devised; an opinion which is confirmed by the respectable testimony which has been adduced.

There is a suitable apparatus for arresting the sparks when the engine is going backward, which it is deemed unnecessary here to describe.

By order of the Committee.

William Hamilton, *Actuary*.

January 14, 1836.

From the Journal of the Franklin Institute.

PRESERVATION OF WOOD FROM DRY ROT.

It is stated as the result of observations made in the German mines, that pine wood which has been exposed to the action of water under pressure, is not subject to the dry rot. A stick of pine wood, placed in water in an iron pipe, absorbed in thirty-six days, 27 per cent. of water. Suosequent exposure for thirteen days, in a warm room, evaparated 15½ parts of the water.

A similar stick of wood, exposed for the same time, but pressed at intervals, by a force of nearly fifty atmospheres, absorbed 118 per cent. of water. Of this, when the wood was exposed as above stated for the other piece of timber, there evaporated 21 parts.

The wood was not sensibly increased in bulk by the absorption of the water. The bulk of water absorbed in the second experiment having been nearly one thirty-ninth that of the wood.—[Annales des Mines, vol. vii.

From the Journal of the Franklin Institute.

SPECIFICATION OF A PATENT FOR AN IMPROVEMENT IN THE MODE OF TURNING SHORT CURVES UPON RAILROADS, WITH RAILROAD CARRIAGES, PARTICULARLY THOSE ROUND THE CORNERS OF STREETS, WHARVEE, ETC. GRANTED TO JAMES STIMPSON, CIVIL ENGINEER, BALTIMORE, MARYLAND, AUGUST, 23D, 1831. PATENT SURRENDERED AND REISSUED ON AN AMENDED SPECIFICATION, SEPTEMBER 26, 1835.

I use or apply the common peripheries of the flanches of the wheels, for the aforesaid purpose, in the following manner.

I lay a flat rail, which, however may be grooved, if preferred, at the commencement of the curvature, and in a position to be centrally under the flanches of the wheels upon the outer track of the circle, so that no other part of the wheels which run upon the outer circle of the track rails, shall touch, or bear upon, the rails, but the peripheries of the flanches, they bearing the whole weight of the load and carriage; while the opposite wheels which run upon the inner track of the circle, are to run and bear upon their treads, in the usual way, and their flanches run freely in a groove, or channel; which treads are, ordinarily, about three inches in diameter, less than the peripheries of the flanches. Were the bearing surfaces of the wheels, which are in contact with the rails, while thus turning the curve, to be connected by straight lines from every point, there would thus be formed the frustrums of two cones, if there be four wheels and two axles to the carriage; or, if but one axle and two wheels, then but one cone; which frustrums for the wheels representing their extremities, will, if the wheels are thirty inches in diameter, and are coupled about three feet six inches apart, turn a curve of about sixty feet radius of the inner track rail. The difference in diameter between the flanches and treads, before stated, the tracks of the usual width, and the wheels coupled, as stated, would turn a curve of a somewhat smaller radius if the axles were not confined to the

carriage in a parallel position with each other; but this being generally deemed necessary, the wheels run upon lines of tangents, and those upon the inner track being as wide apart in the coupling as the outer ones, keep constantly inclining the carriage outwards, and thus cause the carriage to tend to run upon a larger circle than the difference in diameters of the treads and flanches would otherwise give; but the depth of the flanches, and the couplings, may be so varied as to turn any other radius of a circle desired.

What I claim as my invention, or improvement, is the application of the flanches of the wheels on one side of Railroad carriages, and of the treads of the wheels on the other sides to turn curves upon Railways, particularly such as turning the corners of streets, whaves, &c., in cities and elsewhere, operating upon the principles herein set forth.

JAMES STIMPSON.

From the Journal of the Franklin Institute.

SPECIFICATION OF A PATENT FOR A MACHINE FOR SPREADING INDIA RUBBER UPON CLOTH.—GRANTED TO WILLIAM ATKINSON, LOWELL, MASSACAUSETTS, ATGUST 15, 1835.

The cloth to be coated with India rubber is to be made into an endless web, by sewing its two ends together; and other articles, such as skins of leather, may be coated therewith by spreading them on, and affixing them to, an endless web so made. This web is passed around cylinders which are made to revolve, and the dissolved caoutchouc or India rubber, is spread upon the endless web by the aid of a third cylinder, placed parallel to, and nearly in contact with, one of the cylinders around which the endless web passes.

The dimensions of the machine may, of course, vary, according to the width and length of the material to be coated or covered. In designating certain sizes and proportions of the respective parts, therefore, I do so only for the purpose of facility in description, and of indicating what has been found to answer well in practice.

I make a frame of wood, which may be sixteen feet long, and three feet six inches wide, the bottom timbers being sufficiently stout to support the carriage, and other parts, to be presently described. Into the ground sills, or lower part of this frame, uprights are mortised, which serve to support a rail on each side, which may be three feet four inches from the floor, leaving, however, the sills sufficiently clear within the uprights to form a railway upon which the rollers of a carriage may traverse back and forth.

Upon suitable supports, at one end of this frame, there are placed two cylinders of metal, usually of cast-iron, each of them one foot in diameter, and two feet nine inches long. The axes of these cylinders are in the same horizontal plane, and parallel to each other; around the inner cylinder the web to be coated passes; and the outer cylinder is made adjustable by means of screws, or otherwise, so that it may be brought into contact with, or removed to any required distance from, the web, or cloth. These cylinders are geared together by means of toothed wheels upon their shafts, cut sufficiently deep to admit of the requisite adjustment. The shaft of a pinion by which they are driven has on it a fast and a loose pully; when revolving they turn inwards.

The second, or carriage cylinder around which the endless web passes, is supported upon a carriage, furnished with wheels, or rollers, which run upon the lower rails, or sills. This cylinder is also to be made of metal, and when used as a drying cylinder, it should be large in diameter, say three feet. A windlass is placed at the back end of the frame, from which ropes pass to the cylinder carriage, serving, by means of a wince, to draw the carriage, so as to render the cloth taut. Steam is to be admitted into the cylinder through a hollow gudgeon. For this purpose a steam tube is attached to the gudgeon, its other end passing through a stuffing box in a larger tube, attached to a boiler, thus admitting of the requisite motion of the carriage.

In order to apply the solution of India rubber to the cloth, &c., and to confine it to the proper width, we fit two cheeks, or pieces of wood or metal, so as to rest upon the two contiguous rollers, one at or near each of their ends, and these, when in their places, convert the rollers into a trough, or hopper, for containing the solution. The distance of these pieces from each other is regulated by attaching them together by means of a frame, or rod, at their upper sides, so that they may slide, and be affixed

in their places by thumb screws, or otherwise.

When spreading the rubber on the cloth it is necessary to prevent its adhering to the outer roller, and this, among other methods, may be effected, by means of wet sponges, or brushes, laid along it, or by keeping it wet in any other way.

I intend sometimes to use the drying and the spreading apparatus detached from each other, in which case but two rollers, of any convenient size, will be employed in the drying process, and steam may then be introduced into each of them. I intend also, sometimes, instead of the large drying cylinder above described, to cause the cloth to pass over a stationary metallic box, or steam case, in its passage from the spreading to the straining or carriage roller, making the upper surface of this case convex, that the cloth may be kept in close contact with it; the space between the two sides of such box, or case, need not be more than from one to two inches.

What I claim as my invention, and for which I ask letters patent, in the above described apparatus, is a machine for spreading India rubber upon cloth constructed, and operating, substantially, in the manner of that herein set forth. I do not claim the mere spreading of the substance by means of cylinders, this having been previously done, but we do claim the employment of two cylinders for the purpose, connected together, and made to concur, in producing this effect, acting upon the principles described. I also claim the general arrangement and application of the apparatus, for the drying of the solution by means of steam, either in combination with, or separate from, the spreading appparatus, as I contemplate the using of them either conjointly or separately, as hereinbefore set forth. I do not claim drying cylinders, or boxes, heated by steam, as my invention or discovery, but the combination and application thereof in the way, and for the purpose by me herein fully made known.

HEATING ROOMS WITH HOT AIR.

A correspondent in the south, whose communications we are always glad to receive, has furnished the following:

"I am much pleased with the article on Warming Houses with hot air; and will observe in addition thereto that heated air is but very imperfectly conducted through horizontal tubes. Heat has such a strong tendency to ascend vertically that but little will pass through tubes laid in that manner. Hence rooms that are directly over the furnace are made uncomfortably hot while those which require the heated air to be sent laterally only eight or ten feet, are scarcely warmed at all. This fact has been well tested in Philadelphia, and demands the serious attention of all who wish to adopt this mode of warming houses.

"One of my neighbors has a kitchen stove which had so little draught as to be nearly useless for heating the apartment, until the stove-pipe for convenience was extended into the third story, when the draught was so much increased as to enable him to burn damaged or half decayed wood in it, and to make the room comfortably warm."

Our ideas on these subjects coincide with those of our correspondent; and probably the result of an experiment on a cook-stove in our own kitchen might prove useful, if made public. The pipe entered the chimney scarcely six feet from the floor. It was placed low through fear that its heat would endanger the ceiling above it; and the consequence was, the stove frequently smoked. This discomfort has been almost entirely removed by raising the pipe rather more than a foot, which has materially increased the draught. It now enters the chimney about four inches below the ceiling; and to prevent the plaster from becoming heated, a long piece of sheet iron bent a little on its sides, so as to *lie lengthwise on the pipe*,—intercepts the heat in its ascent. With this contrivance, the ceiling is now less heated than it was before the pipe was raised.

If we consider a stove-pipe as an inverted syphon, we may understand why it may be lead horizontally from the stove to a *distance*, provided it afterwards ascends to a sufficient *height* to cause a draught; and the *height* ought to be proportionate to the horizontal *distance*. The levity of the air by heating is much increased; and the pressure of the atmosphere, being greater at the stove than at the top of the pipe, a strong current rushes along it. In the same way, if a tube for conveying hot air from a furnace, be made to discharge it into the second or third story, after being led to a distance horizontally, we should expect there would be draught enough to answer the intention; but when we undertake to lead heated air horizontally, and then discharge it at the floor of the first story, disappointment must ensue, because we have not proportioned the ascent or height of the pipe to its horizontal distance.—[Genesee Farmer.]

From the Railroad Journal.

AVERY'S ROTARY ENGINE.

We give the following communication from the pen of a friend who should have been an ENGINEER, rather than of that profession heretofore considered almost the only path to eminence, the Law.

To the Editor of the Railroad Journal:

SIR,—It is some time since the attention of the public has been invited, through your valuable Journal, to the Re-acting Rotary Engine of Mr. Avery, of Syracuse, but the merits of the invention do not seem to be duly appreciated, except, perhaps, by those who have an engine of his construction in actual use. I have been informed, however, that in every instance where one of this kind of engines has been put up, it has proved itself superior to the high pressure piston engine. It is quite probable that most engineers have fallen into an error in theory in calculating upon the power of Mr. Avery's engine, by misapplying one of the first principles of mechanics—"*that action and re-action are equal.*" Starting with this theorem, which is admitted to be true, one would very readily be led into an erroneous conclusion by reasoning in this manner:—"Action and re-action being equal, and the most that can be obtained by a fluid impinging upon the vanes of a wheel, is an effect equal to one third of the power applied, therefore the effect in the re-acting engine is only one third of the power of the steam used," from which must be deducted the usual discount for friction, &c. This conclusion is plausible, but erroneous, as can be shown by comparing the different circumstances under which the power is applied in the two cases. In the case of a fluid impinging by direct action upon vanes or paddles, if any motion whatever is produced, the vanes must necessarily move in the same direction with the impelling fluid, and the velocity of this motion must be deducted from that of the stream, so that the greater the velocity of the wheel the less is the impulse. In the reacting engine there is no loss from this source. The motion may be greater or less, and not affect the impelling pressure, because the power moves with the revolving arms, and whatever may be their velocity the enclosed steam and those arms are relatively at rest, and the pressure upon the side opposite the orifice is precisely the same when in the most rapid motion as when standing still.

It is upon this principle that the rocket ascends with astonishing velocity, the reacting pressure not being in the least diminished by the ascending motion.

If I am correct in the *rationale* of the reacting engine, we need not be surprised that it should perform at least as much with the same fuel as the common high pressure engine, which at best falls far short of the actual initial power of the steam employed.

HIERO.

REMARKS AND INQUIRIES RESPECTING MR. AVERY'S PANENT STEAM ENGINE.

To the Editor of the Journal of the Franklin Institute.

Sir,—You have doubtless seen, in a late number of the New-York Mechanics' Magazine, (the one for September, I think,) an engraved drawing of "Avery's Rotary Steam Engine," accompanied by a description. It is generally believed that this engine has been *secured* to Mr. Avery by patent. I have always supposed the main object of the patent law to be, the *protection* of *original inventors* in the enjoyment of whatever pecuniary advantages they may fairly derive from their useful inventions.

That Mr. Avery's engine, or one constructed upon the same principle of action, though perhaps somewhat different in detail, will be found in some situations a convenient and economical machine, I do not doubt. Indeed, I know some persons who would like to make use of such engines, but who are, some of them, unable, and all unwilling, to pay Mr. Avery for the privilege of doing that which they feel themselves equally at liberty to do with himself. My reasons for doubting the validity of his patent, may be found, *first*, by referring to the September number of the New-York Mechanics' Magazine for 1833, in which is given a drawing and description of the beautiful contrivance of Hiero, the first account of which is said to have been published in the year 1571.

The principle upon which Mr. Avery's engine acts, will, I think, be seen at a glance, to be the same as that of Hiero's. *Secondly*, in a work by Oliver Evans, entitled the "Young Steam Engineer's Guide," published by Carey & Lea, page 93, the biographer of Mr. Watt, speaking of his first

attempt to produce a direct circular motion by steam, says, "he (that is, Mr. Watt) then tried Parent's or Dr. Barker's Mill,* inclosing the arms in a metal drum which was immersed in cold water; the steam rushed rapidly along the pipe which was the axis, and it was hoped that a great reaction would have been exerted at the ends of the arms, but it was almost nothing, the reason seems to be that the greatest part of the steam was condensed in the cold arms. It was then tried in a drum kept boiling hot, but the impulse was now very small in comparison with the expense of steam." Upon this experiment Mr. Evans remarked as follows: "It is evident, from this account, that Mr. Watt has used *weak steam*, and placed dependance on the use of a condenser; had he in his experiment with Doctor Barker's Mill, lessened the apertures by which the steam issued, so as to confine the steam until the power in the boiler was equal to 100 lbs. to the inch, he would have been astonished to see it revolve about 1000 times a minute, supposing the rotary tube to have been three feet in length; I have tried the same experiment, but without the least hope of success, on any other principle than by confining the steam to increase its elasticity to a great degree. My rotary tube was three feet long, the elastic power of the steam about 56 lbs. to the inch; it revolved with a velocity of about 700 to 1000 times a minute. The aperature by which the steam issued about $\frac{2}{10}$ of an inch in diameter; it exerted more than the power of two men, and would answer to turn lathes, grindstones, &c., when fuel is cheap. I have specified and explained it in the Patent Office." Unfortunately, there is no date to this work of Mr. Evans, but I presume it can be readily ascertained in Philadelphia, when it was published, and probably when the specifications were entered at the Patent Office. But that it was done long before Mr. Avery's engine was thought of, I think there can be little room for doubt, as it appears from another part of the same work of Mr. Evans, page 96, that he *matured* his experiments upon the application of steam to a wheel, in the year 1784, which, as he states, he described in the Patent Office.

Under these circumstances, I cannot see what possible claim *Mr. Avery* can have to a patent for this invention; as to the drum which incloses the arms as represented in the drawing of his engine before referred to, I understand it is claimed as having been first applied to it, by a Mr. Clark, of some western town in this State.

By giving the foregoing an *early* insertion in your Magazine, you will, sir, *essentially* oblige several of the friends and readers as well as promote the cause of justice. Should you be willing to express your own opinion as to the merits of this question, it would be deemed particularly valuable.

FAIR PLAY.

Remarks on the foregoing communication, by the Editor.

It so happens that "Fair Play," and others, who desire information on the subject of Foster and Avery's Re-acting Steam Engine, (commonly called Avery's) will, in the present number, have a full opportunity of seeing what constitutes the claim of these gentlemen to a patent for an improvement in this machine. They were fully informed respecting what had been attempted with engines similar in construction to their own, previously to their obtaining a patent; and it will be seen that they have confined their claim to improvement within very narrow limits, and so far as we are informed, their claim is a valid one. It may be said that their improvement is trifling; that, however, is their own concern, as those who do not need it are at full liberty to use the machine in any of the various forms which had been previously given to it, or to devise others which are new, without buying from them what may be deemed unimportant.

We are not sufficiently well informed respecting the comparative results obtained from Avery's and the reciprocating, or Avery's and other rotary engines, to make up our minds respecting its real value; between four and five years, however, have elapsed since this engine was patented, and it has been at work at Syracuse, and various other places, during the whole of that time, so that those who have seen it, and who possess a competent knowledge of the subject, have had time enough to investigate it. Before the patent was obtained, we expressed to Mr. Avery, our general want of confidence in the real value of such engines, and our doubts respecting the importance of the improvements claimed; and we did not suppose that the career of the one in question would extend to two years; a length of life, greater than has usually fallen to the lot of rotary engines; it still lives, however, maugre our anticipations, and all the reports which we have received relating to it, tend to show that it has not yet exhibited the first symptoms of decline. Although we still adhere to the opinion, that upon a full comparison, the economy of a good reciprocating, will be greater than

* Descriptions of Barker's Mill may be found by your readers, in Ferguson's Lectures, Nicholson's Operative Mechanic, and almost every reputable work on Mechanics now in use.

that of any rotary engine that has been, *or will hereafter be*, made, we most cheerfully confess that we have a much better opinion of Mr. Avery's, than we at first entertained; and, as to our wishes, they are that, by the operation of this, and a hundred other contrivances, which we have esteemed of like value, we may be put entirely in the wrong; let the fact be well established, and we would be the first to make it public. Without putting in an undue claim to the *suaviter in modo;* we have sometimes thought that the tendency of our animadversions upon patented inventions was to place us in the situation of "The best good-natured man, with the worst ill-natured muse;" it must be recollected, however, that we stand between the claimants of exclusive privileges and the public.

With respect to the amount of novelty necessary to security, as a foundation for a patent, we think that the fair test of this is the utility of the improvement; if it renders that valuable which was of little comparative worth, it is enough, although it be no more than the addition of a screw, or of a peg. The views which we have adopted upon this subject, may be found at large in Vol. 8, p. 411 of this Journal. The article is a borrowed one, and well worth perusal. "The main object of the patent law is the *protection of original inventors* in the enjoyment of whatever pecuniary advantages they may fairly derive from their useful inventions," and in attaining this end, it is not possible to test them by comparative weights, or to measure them by any established scale; absolute quantity, however small, is all that can be required.

DECISION OF THE CIRCUIT COURT OF THE UNITED STATES, FOR THE EASTERN DISTRICT OF NEW-YORK, IN A PATENT CASE INVOLVING SOME IMPORTANT PRINCIPLES. TO WHICH IS APPENDED SOME REMARKS BY THE EDITOR.

UNITED STATES CIRCUIT COURT.

BEFORE JUDGE THOMPSON.

Henry Stanley vs. *Henry Hewitt.*

This was an action founded upon a patent granted to the plaintiff, Henry Stanley, by the United States, the 17th December, 1832, upon a specification and application made to the patent office the 11th of October, 1832, for an improved rotary cooking stove. The plaintiff, by several witnesses, proved the originality of the invention in him, its importance and usefulness, and that the defendant had, from patterns taken from the plaintiff's stove, made and caused to be made, and sold a large number of stoves, and was still pursuing the business. The defendant, to show that the plaintiff's patent was void, called Elisha Town and his son, and others, to prove that in 1823 and 1824, he invented, and procured to be cast, a rotary stove, and that the plaintiff's stove revolved like it—also a Mr. Gould, to prove that the plaintiff took the collars and flues in the cap of his stove from said Gould's stove, and also other witnesses to show that the plaintiff, as well as others, had used the collars and flues long before the plaintiff's improved cooking stove was invented; and also, that the defendant attempted to show that the ptaintiff had sold his stoves, and given his invention to the public before he applied for his patent.

The plaintiff, in reply, called numerous witnesses to show that Town's stove, whatever it was, was useless, and had been abandoned as such; and that the plaintiff had no knowledge of it when he made his invention and improvement, and that his stove, in all the important improvements by him claimed, was wholly unlike Town's stove, and that collars and flues were not claimed by him as his invention, independently of his rotary plate in which they were attached, and that when they were put upon the Gould stove, it was done at the plaintiff's suggestion. And that all the stoves delivered out before the application for the patent, were delivered to be used on trial, and with a view to test the utiliiy of its improvements. The trial was a very labored one, and occupied five or six days; but finally resulted in a question of law, growing out of the wording of the specification; which appeared to have been drawn up by the plaintiff without proper legal advice.

On the part of the plaintiff, it was insisted that the claim, in his summary, was for a combination of certain improvements he had made in the cooking stove, connected together and attached to the top or cap of his stove, put in motion; and that it was the combination which he claimed, and not the parts forming the combination separately, and that his specification would bear that construction.

On the part of the defendant, it was insisted that the plaintiff had so worded his specification, that it would not bear that construction, and that it really claimed the different parts comprising the top or cap of the stove separately, and independently of any combination, and that his specification was otherwise defective.

Judge Thompson, in the progress of the cause, gave his opinion that putting the stoves out on trial, and for the purpose of experiment and improvement, was not such a public use of them as would be consider-

ed as a dedication to the public—that the plaintiff was justified and had a right to test the utility of his invention, and see what improvements might be made before he applied for his patent, and that this was an article which would be tested by being put into several families, where it might be differently used by different housekeepers.

In charging the jury, Judge Thompson, after stating the case and the difficulties arising from the obscurity of the language employed in the summary of the specification, remarked that in all cases, where consequences of great importance to the parties were involved, the jury must expect that the views of each would be presented with great earnestness and zeal. Nor is it surprising (said he) that in such controversies, matters not materially connected with the merits of the issue, should be brought before the Court and Jury during the progress of the trial.

These remarks are applicable to the case now under consideration. It evidently involves matters of importance to the parties concerned, and has been accompanied by circumstances having no material bearing upon the questions in issue. *We*, however, are to examine the controversy, and determine it, by the law and the evidence, without reference to extrinsic matters, having no bearing upon its merits. And in this view of the subject, it is of no consequence whether the plaintiff, Mr. Stanley, has, or has not, accumulated a fortune, as the fruits of his invention. If, by his own talents, industry, and perseverance, he has produced a machine, useful in itself, and approved of by the public, he is entitled to the protection of the law, so far as he has rights to be preserved and guarded. And if, on the other hand, he has interposed claims which cannot be the subject of legal sanction, he must abide by the consequences of his fault, or misfortune.

I state to you, gentlemen, in the outset, that this is not a case free from difficulties. But I have the consolation of knowing that my decision of the matter *need* not be final, and that any mistakes committed *here*, may be reviewed and corrected by another tribunal, where I, too, shall have an opportunity of considering the subject with more care.

In my view of the case, much evidence has been introduced upon both sides, which is entirely irrelevant. The plaintiff's rights, whatever they are, depend upon his patent, and if he has any by his patent, and has not abandoned them to the public, he is entitled to protection. I confess to you, that my own prepossessions lean towards useful improvements, and I would construe the patent act with a liberal spirit, and expanded views. It is a beneficial law, having its foundations in public policy. Its object is, to encourage the enterprise of ingenious men, that the results of their labors, being brought into view, may be first enjoyed by the inventors for a limited period, and then dedicated to the public benefit forever afterwards. Nevertheless, I do not mean to say that all patents are to be protected *at all events*, but those only are to be sustained which have the sanction of law. It is a well known fact that patents are granted at the Patent Office, not after an examination into their merits, but upon *ex parte* statements, and hence their real claims may be afterwards investigated with proper strictness in a court of law.

There are some general rules always to be observed while considering this subject. In the first place, to entitle a patentee to maintain an action for a supposed violation of his rights, his invention must be both useful and new; not that its usefulness is to be scanned with a critical eye, to ascertain a given amount of benefit to be derived from it, but the invention must be useful, as contradistinguished from that which is frivolous, or wholly worthless. If not frivolous, or entirely useless, the requirements of the law in this particular are complied with.

With regard to the invention before us, it is clearly useful; this is proved by the testimony of witnesses on all sides. It is proved, also, by the great extent of the plaintiff's sales, by the favor of the public, which has been liberally bestowed upon it, and by the palpable imitations of the plaintiff's models in the case under consideration.

If the plaintiff has legal rights here, there can be no doubt that they have been violated by the defendant. There is no substantial difference between the stove made by the defendant, and that invented by the plaintiff; the one is a copy of the other. And as to the extent of the violations, there is as little doubt. If you believe the testimony of Mr. Randal, the defendant sold a hundred stoves before the commencement of this suit, if his own declarations are to be credited, for he told the witness, in express terms, not only that a hundred stoves like these *had been sold* in Vermont, but that they had been sold *by him*. If this witness, therefore, is worthy of credit, (and he stands entirely unimpeached in every respect,) there can be no doubt that the plaintiff's right have been violated by the defendant, if, in fact, it shall appear that he has any which the law can protect.

But the great question is, whether he has any such rights, and the solution of that question is to be found in the patent itself.

And here I may remark, that much has

been proved and said in relation to the inventions of Town and Gould. The evidence upon these points is only important in one point of view, and in that it will be here considered. It shows that the materials, or component parts, of Stanley's stove are not in themselves *new*; and if the plaintiff claims a combination of things, he has evidently taken old materials to form his machine with, whatever it may be.

In relation to this part of the case, I would observe, that the particular words used in the specification and summary of this patent are of no importance. The office of words is to convey ideas, and our province is to determine what the party intended to express by the language employed. Did the patentee intend to claim the discovery of a *principle*, in the abstract or philosophical sense of that term? or did he intend to describe a contrivance, or machine, new and dseful in reference to the purpose for which it was produced? He claims in his summary, "*the* revolving top plate," as a constituent part of his invention, and the first inquiry is, whether, before the use of Stanley's stove, a contrivance had been used by which the utensils to be heated had been brought over the fire, by means of a top revolving upon its centre. If the patentee claims this revolving *motion* as his own discovery, in its application to a cooking stove, he evidently includes in his patent that which is not his own discovery; for Town's stove had a revolving top, or drum, intended to accomplish the same object, by means somewhat similar.

It is very possible that Town could not maintain a patent for that invention, because he long ago gave it up, and abandoned it to the public. He did not, however, abandon it to the *plaintiff*, and all other persons might use it as well as he. If Town's discovery was abandoned, the only claim to it which Stanley can maintain, is the use of the thing as a part of his combination; and here we must determine what Town's invention was.

It is evident that he invented a revolving drum or top of a stove, to convey vessels to and from the fire by a rotary motion, and concentrate the heat around them when placed there. This contrivance he gave up, or abandoned, because it was useless, that is, useless in its then combination, though not in the abstract—for the principle or contrivance, as to the revolution, remains. As a cooking machine, the stove of Town was good for nothing; but its revolving motion might be made useful when brought in connexion with other constituents properly adapted to the objects in view.

The same remarks are applicable to the raised cones, or collars, and the flues. Each of these was old, and each had before been used either by itself or in other combinations. Stanley himself had used the collars in his own stove, as far back as the year 1828. So had Wilson—and this part of the machine is confessedly old. So with regard to the flues. If Stanley was the inventor of these, he had abandoned them to the public long before the date of his patent, and he cannot, therefore, now claim them as the subject of a patent. But the question is, whether Stanley *does* claim these materials or constituents as his invention?—for if he does his patent is void. He would then claim as his own the discoveries of others, or endeavor to maintain that which he had, by use, dedicated to the public.

If, on the other hand, the patentee claims a *combination* here, and nothing more, then I have no hestiation in saying that his rights are secured. If he goes for the elements or constituents of his machine, his patent is void, but if he merely claims a new combination of old materials, his rights may be protected. The patent itself is somewhat obscurely drawn, but the invention is useful and meritorious, and I am disposed to give it all the protection which the law will allow. A liberal construction should be given to these instruments, nor should a severe criticism be bestowed upon language used, for the most part by the inventors themselves, who are, in many cases, altogether unskilled in the use of technical terms. We are always to ask ourselves on these occasions, what was the intention of the writers, and if that be discovered, the particular words used are altogether unimportant.

With these views, and under these considerations, I proceed now to give you my notions as to what this patent contains. It concludes with a summary in the following words:—" the *principle* for which I claim the invention, and for which I ask letters patent," is "the revolving top plate or fixture into or on which are placed the principal utensils used in cooking," &c.

By the patent law, the party is required to describe that which he makes, that the public may understand *the thing*, and be able to construct the like after the patent shall have expired; and hence there is a necessity for a proper observance of this requirement of the act. In this case, the plaintiff claims the specific thing set forth in the summary, and we must turn to the specification in order to understand what that thing is. The term used in the summary is "principle," but a reasonable interpretation must be given to it, or no sensible exposition of the parties' meaning can be obtained. He evidently did not intend to claim the discovery of an abstract thing,

or entity, but some tangible mechanical contrivance, described in the specification. By "*principle*," he evidently intended a contrivance or thing described; and as there is no magic in words, we may fairly give this interpretation to the term used.

The plaintiff then patents *this* "revolving top plate," with its collars and flues, but instead of describing his invention as it really is, a *combination*, he describes the constituent parts. His improvement consists of a combination, and he should so have described it, and I have no doubt that a specification may be drawn which will secure all his rights. If the plaintiff had properly described his invention as it actually exists, his patent would have been good, for then the combination would have appeared.

From the London Repertory of Patent Inventions.

OBSERVATIONS ON INSECTS PRODUCING SILK, AND ON THE POSSIBILITY OF REARING SILK CROPS IN ENGLAND. BY THE REV. F. W. HOPE, F. R. S., ETC.

Previously to entering on the subject of this paper, I will offer some statistical *details*, illustrative of the vast importance to the commercial prosperity of this great country, of the few insects producing silk. These details may stimulate the entomologist to pursue particular lines of inquiry; and may we not hope that the result of such researches will be the addition to our productive sources of various new species of these little laborers, to whom man owes so much?—species which might be available at our own doors, by the capacity of enduring our climate, and thriving on its vegetable productions, and, in case it were necessary, by having recourse to artificial means for their culture? May we not suppose the manufacturer would find his hot-houses for silkworms as profitable a speculation, with extended demand, as the fruiterer does his hot-house for the supply of the comparatively limited demand for the luxurious desserts of the rich?

In the years 1822–3, respectively, the quantity of silk imported for home consumption was 4,392,073 lbs. and 4,758,453 lbs., being an increase of $3\frac{1}{4}$ per cent. in the latter year. The value of the exports for those years was 529,990*l.*, and 740,294*l.*, being an increase of 40 per cent. in one year. The average for ten years, from 1814 to 1823, and the succeeding ten years, exhibits a more striking and gratifying difference; the first period giving for annual home consumption 1,580,616 lbs., and the last ten years, 3,651,810 lbs., being an increase of 131 per cent.

On the authority of Mr. Winkworth, I state the number of persons employed in England in the silk trade in 1823 at 500,000; and at the present moment there are probably 700,000 engaged in it. Leaving these details for the present, let us now proceed to the examination of insects producing silk.

The chief insects which produce silk are ichneumons, spiders, and moths. My friend, Mr. Stephens, will this evening exhibit to your notice a specimen of ichneumon-silk; and as it is more likely to prove an object of curiosity than utility, I pass on to spider-silks.

Several genera of spiders produce silk of various strength and qualities, such as the gossamers, and our domestic species, as well as many others. In France, Monsieur Bon had gloves and stockings manufactured of it: sufficient experiments, however, have not yet been made to ascertain the quantity and quality of spider-silk.

If in Rome the whimsically extravagant emperor, Heliogabalus, collected 10,000 lbs. weight of spiders, as a vain display of power, surely in this metropolis we might collect a sufficient quantity of cobweb to perfect any experiments on a silk likely to be as strong as that obtained from *Bombyx Mori*, and probably less impervious to wet; a silk, however, not likely ever to be much in vogue, from the natural antipathy which prevails against spiders, from the difficulty and expense in collecting the web, and the impracticability in breeding spiders in any numbers, arising from their voracious and predatory habits: but the cocoons might be gathered and unwound. Abandoning our indigenous webs, such as float over the fields, as well as those which hang in dusky wreaths in garrets and in cellars, we may naturally expect to meet with exotic and tropical species which yield silk worth attention. It is probable that the cylindrical sacks of the gigantic *Mygale* may be advantageously collected, as the cocoons equal in size

large walnuts, in one nidus of which 100 young ones have been discovered: it is reported, also, that some kinds of web are so strong that birds are entangled in the meshes, and that their webs oppose a certain degree of resistance even to man himself. In concluding my remarks on spider-silk, I would recommend that attention be directed to the silk obtained from *Epeira clavipes,* a spider abundant in Bermuda: fine specimens of its silken cocoon may be seen at the British Museum; and other species of the same genus also are deserving of attention.

MOTH SILK.

The principal moths producing silk belong to the genera *Clisiocampa Bombyx,* and *Tinea.* The *Bombyx Mori* (the proper type of the genus) yields it in great abundance: This species has become naturalized in the fairest portions of the globe.

As it appears from the statistical details, that silk is so intimately connected with our commercial and manufacturing interest, it is evidently worth while, for the prosperity of those interests, to recommend its increased cultivation; and really, if ever there was a period when its cultivation could be carried on with increased success, it is the present moment. Look at our Indian possessions in the full enjoyment of peace: the English, ruling these extensive territories, might induce the natives to grow (if I may use the term) any quantity of silk, sufficient to glut all the markets of Europe. In these regions there are generally eight successive silk crops; some authorities assert even more. Extending, moreover, our views to China, as the trade with that country is now thrown open to British capital, enterprise and industry, we may naturally expect that a stimulus may be applied there to its increased production. Abandoning, for the present, however, foreign produce, it remains to state the possibility of growing silk in England, and this part of my subject requires a thorough investigation. Prussia, Bavaria, and even Northern Russia, whose climates are not superior to our own, grow annually large quantities of silk; and why does not England do the same? the answer is, the price of labor is here too high; secondly, the experiments tried have already failed. Notwithstanding these assertions, I think that it is possible to grow silk in England, and grow it even with success and profit. To meet these objections, I would suggest, first, that we ought to breed silkworms in hot-houses throughout the year; and, secondly, that the Pavonia Moths of Europe and other countries, as well as the Atlas Moths of Asia, should be reared in like manner. It has already been remarked, that several crops are obtained in the East within the year; and why may we not also expect in England several, by means of breeding the worms in hot-houses? In India, the longest period for a generation of silkworms appears to be forty days: even allowing fifty days in England for a generation, we may then expect seven crops of silk. If we only obtain four, that is double the number produced in Italy, where they annually rear but two. I need now scarcely add that four crops will no doubt repay the speculator for rearing silk. To reduce, however, his expenditure as much as possible, I would recommend him to feed the silkworms with lettuce instead of mulberry leaves; first, as there is less expense in the cultivation; secondly, as the lettuce can be grown cheaply in cucumber frames during the winter months; and, lastly, as the quality of silk does not depend so much on the *quality* of the *leaf* as it does on the *degree* of temperature in which the worm is reared, I would strenuously recommend the lettuce. Should the food of the mulberry tree, however, be preferred to the lettuce, we can still adopt the discovery of Ludovico Bellarde, of Turin. His plan consisted in giving the worms the pulverized leaves of the mulberry trees slightly moistened with water: the leaves were gathered in the previous summer, dried in the sun, reduced to powder, and then stowed away in jars for the winter food, or till the tree was in full foliage. Repeated experiments made by Bellarde prove that the worm preferred this kind of food to any other, as they devour it with the greatest avidity. To reduce still further the expenditure, old men, women, and children, might be employed in feeding the worms, as is the case at present in India: indeed, might not the poor in the workhouses be

rendered available, thus affording them amusement and profit?

With regard to rearing other silk-moths, I am well convinced that the *Pavonia minor* might be propagated to any extent in this country, as the larva are general feeders, probably the Laquey Moths might also be reared with success; the larger *Pavoniæ* of Europe and other countries, should also be tried. But a great object would be to import the eggs and breed the Atlas Moths in England, which have already yielded a fine silk, well worthy the attention of the manufacturer of Great Britain.

As there is not time at present to enter into the merits of the Tasseb, Arrindi, Bugby and Kilisurra silkworms of India, I merely mention the chief writers on this subject, viz. the celebrated James Anderson, Dr. Roxburgh, General Hardwicke, and Colonel Sykes; the two last, I am happy to say, are members of this Society, and I am sure will most willingly give all assistance in their power towards the attainment of so desirable an object as that of rearing silk in this country.*

In concluding these remarks, I would suggest the formation of a committee to investigate all that relates to silk. Let the silk manufacturer learn that the committee is disposed to give him all the assistance in its power, that it is equally desirous of his advice and observation; let the mechanic learn that we need his practical aid, on which he alone can give us useful assistance. A report, emanating from this Society, embodying in it the opinions of the manufacturer and entomologist, would do some good. If the object of producing silk in England fail altogether, we shall still have the merit of meaning well; should it succeed, however, thousands of our poorer countrymen will find employment and reap the benefit. —[Transactions of the Entomological Society of London, vol. i.]

* Should the first attempts fail, eventually there is every reason to believe that success must follow perseverance, as it has already done in other countries. Till that wished for period arrives, I would earnestly recommend not only the increased cultivation of silk in India, but in all our colonies, most particularly in New-Holland. At the Cape of Good Hope, at the Mauritius, at Malta, at the barren rocks of St. Helena, the silkworm has been introduced with partial success; and from those countries may we not in future calculate on some increasing produce?

From the London Repertory of Patent Inventions.

ON SOME RECENT EXPERIMENTS MADE WITH A VIEW TO PROTECT TIN PLATE OR TNNED IRON FROM CORROSION IN SEA-WATER, WITH SOME PROBABLE APPLICATIONS; AND ON THE POWER OF ZINC TO PROTECT OTHER METALS FROM CORROSION IN THE ATMOSPHERE. BY EDMUND DAVY, F. R. S., M. R. I. A., ETC., PROFESSOR OF CHEMISTRY TO THE ROYAL DUBLIN SOCIETY.

If a piece of tin plate is exposed in sea-water for a few days, it will exhibit an incipient oxidation, which will gradually increase; the tin will be preserved at the expense of the iron, which will be corroded. But if a small surface of zinc is attached to a piece of tin plate and immersed in sea-water, both the tin and iron will be preserved, whilst the zinc will be oxidated, on the principle first made known by the late Sir H. Davy.

The author has exposed for nearly eight months in sea-water a surface of tin plate nailed to a piece of wood by means of tinned iron tacks, inserting between the wood and the tin plate a small button of zinc. Under these circumstances the tinned plate has remained clean and free from corrosion; the zinc has of course been corroded. In a comparative experimet, in which a similar piece of tin plate was nailed to the same piece of wood, and exposed, during the same period, to the same quantity of sea-water, without the zinc, the edges on two sides of the tin plate were quite soft from the corrosion, which had extended to about one eighth of an inch. These experiments seem worthy of being repeated and extended.

The present demand for tin plate is very great; should these statements be confirmed, a vast increase in its consumption might be anticipated. The opinion may be entertained that it is practicable to substitute double tin plate for sheet copper in covering the bottoms of ships, &c., using zinc in small proportions as a protector. Such applications would probably occasion a saving of nearly three fourths of the present expense of copper sheathing.

It also seems deserving of inquiry, whether tin plate vessels, protected by zinc, may not be advantageously substitu-

ted for copper vessels in many of our arts and manufactures, and even in domestic economy. Although it might be presumed, from Sir H. Davy's experiments and observations,* that zinc would protect tin plate from corrosion in sea-water, the author is not aware that any direct experiments on the subject have been published. Sir H. Davy briefly refers to some obvious practical applications of his researches, to the preservation of finely divided astronomical instruments of steel by iron or zinc; and that Mr. Pepys had taken advantage of this last circumstance, in inclosing fine cutting instruments in handles or cases lined with zinc. The author has not heard whether such applications have succeeded, but he has made a number of experiments with a view to protect brass, iron, copper, &c., from tarnish and corrosion in the atmosphere by means of zinc; the results obtained, however, lead to the conclusion, that contact with zinc will not protect those metals in the atmosphere, the electricity thus produced, without the intervention of a fluid, being apparently too feeble to counteract the chemical action of air and moisture on the surfaces of the metals.†

From the London Repertory of Patent Inventions.

OBSERVATIONS ON THE RAVAGES OF LIMNORIA TEREBRANS, WITH SUGGESTIONS FOR A PREVENTIVE AGAINST THE SAME. BY THE REV. F. W. HOPE, F. R. S , ETC.

In laying before the Society some specimens of wood perforated by *Limnoria terebrans* (a crustaceous animal allied to the marine *Oniscidæ*, or sea wood-lice), my chief object is to elicit any observations which may tend to counteract its ravages.

A very able paper, by Dr. Coldstream, appeared in April last, in Professor Jameson's Journal, wherein its history, habits, and anatomical details are sketched with an accuracy which does honor to this useful pupil of Leach. It lives on the wood, which it perforates, and, as far as I have observed, so also does *Ligia oceanica*, and probably others of the *Oniscidæ*, marine as well as terrestrial. This fact, however, I believe, was first made known to us by Dr. Coldstream, who states that the contents of the stomach resemble comminuted wood. From finding the common wood-louse in outhouses, and *in and about* decaying timber, it appears to me not improbable that they also may partly feed on wood.

I hope I may here be allowed to express a wish that some of the members present will examine the contents of the stomach of the common wood-louse under a powerful microscope, and give us at some of our meetings the result of his investigation.

As the generic characters of *Limnoria* are well laid down, and as the animal is figured in the above quoted journal, I pass on to the objects of its attacks, and also to the remedies which have been applied to counteract its effects.

Fir, birch, and oak were nearly all attacked by it. Teakwood alone remained unperforated; probably, therefore, other *ironwoods* may be employed with like success. Among the experiments made to resist this evil, the following were the most important:

1st. Covering the piles with broad-headed nails, called scupper nails, the oxidation of which impregnating the wood yields a taste disliked by the animal. This plan, for a time, succeeds: the rapid consumption of iron, from the action of salt water, at length rusts off the broad heads, and it is necessary continually to replace them. Some have used copper sheeting with partial success; others have used common tar, with which they daub the piles before they bury them in the sea; but in a short time, from abrasion, the piles are robbed of this coating, and become perforated by the *Limnoria*.

There is an announcement in the public journals, that Mr. Stevenson has discovered a varnish capable of protecting wood from the attacks of this destructive pest. What this varnish may be, I am at a loss to conjecture; I only hope that Mr Stevenson will shortly make his discovery known, and as publicly as possible, as he may be the means of saving the wood-work of our flood gates, timber bridges, chain piers, and docks from inevitable destruction.

At the chain pier at Southend, in Essex, the piles are daubed over with gastar; and from inquiries made on the spot from the workmen employed, I found that

---

* Phil. Trans., vol. cxiv., for 1824; [or, Phil. Mag., first series, vol. lxiv., p. 30, 233; vol. lxv., p. 203.—Edit.]

† [The negative results thus obtained by Mr. E. Davy, agree exactly with those of some trials which I have witnessed for protecting steel by this means.—E. W. B.]

there exists a general belief that where common tar fails, gas tar succeeds, the insects, as the workmen assert, not liking its taste.

Both the varnish of Mr. Stevenson and the gas-tar may succeed for a time; abrasion, however, will at length remove them: would it not, therefore, be possible, by means of perforated iron pipes running through the centre of the piles, occasionally to supply liquidated tar, and so keep up this gaseous influence? The expense of the pipes would probably be too great. It is ascertained that the *Limnoriæ* attack neither the bottoms of ships nor fresh-tarred piles newly placed in the sea, partly, perhaps, as it requires time for abrasion to take place, and partly as the effect of the tar is not neutralized by salt water. Tar appears to be an antidote: gas-tar may be more efficacious; and as the oxidation of iron is effective for a certain period, probably by uniting two or more of these, we may preserve the piles for a longer period than has hitherto been done. In the sea I would form a bed of gas-lime, next add a thick stratum of gas-tar, and then drive the piles into it, coating them well over with gas-tar before-hand; by these means some good might be effected. By nailing also to the piles portions of honeycombed wrought-iron gas pipes (which might be purchased, I imagine, for a mere trifle) the gaseous taste might be kept up. Another remedy might be tried by saturating the piles with strong solutions of corrosive sublimate: moreover, should the spirit of caoutchouc (or India-rubber) be found eventually to be disliked by the *Limnoræ*, we shall then have a cheap and easy remedy.

So long as wood is used in the bedding of our marble public works, so long the annual loss must be great. As in 5 or 6 years the wooden piles become perforated and nearly useless, might it not be possible, by means of cast-iron hollow pipes filled with cement, and coated with a varnish externally, to make them last for 20 or 30 years? As this is a mere matter of calculation as to expense, I do not wish to enter upon it; any observations which may tend to keep the wood sound for a long period, is the present object of inquiry.

In concluding these observations, I have only now to add, that I think an inquiry on the subject of antidotes against the *Limnoria* is well worthy the attention of this Society: and I assure myself that the majority of its members unite with me, when I express a wish that as a body we may be equally distinguished for practical usefulness, as for entomological science. In short, if we can save the wood-work of chain-piers and docks from the destruction of the *Limnoria*, and diminish the ruinous expenditure they entail upon us, the Society will establish no small claim to the gratitude of the public.

Various suggestions were made by different members present at the reading of the preceding paper, for the institution of experiments to prevent the attacks of the *Limnoria;* and it was proposed by Mr. Yarrell (notwithstanding the statement made by Mr. Children, that insects immersed in a solution of corrosive sublimate will revive, after remaining immersed therein for at least twenty minutes), that the saturation of piles, &c., in such solution might, by the formation of a new compound formed by the action of the corrosive sublimate upon the wood, have the effect of preventing the attacks of insects, as well as the not less injurious attacks of the dry-rot and other vegetable causes of decay.—[Trans. Entomol. Society, vol. 1.] A. T.

CURIOUS DISCOVERY.—NOTICE OF A NEW MODE OF PRESERVING ANIMAL BODIES.—COMMUNICATED AT THE EDITOR'S REQUEST, BY MR. HENRY N. DAY.

The following account of an interesting discovery, recently made in Italy, is taken from a pamphlet published in Florence, during the last summer.

The author of the discovery, Sig. Girolamo Segato, is already favorably known to the scientific world, as the author and engraver of improved maps of Africa and Morocco. Ardent in the pursuit of science, he traversed the deserts of Northern Africa, and by his researches, corrected and considerably advanced the knowledge of those regions. It was while travelling in these parts, that he received the first hint of this great discovery. In the path of one of those interesting phenomena of the African deserts—a vortex of sand—which his curiosity prompted him to trace, he, one day, discovered a carbonized substance, that upon closer investigation proved to have

been originally animal matter, and to have been carbonized by the scorching heat of the sand. He afterwards discovered an entire human carcass, partly black, partly of a sooty hue, about a third less than the ordinary size of man, and all perfectly carbonized. It occurred to him that this accidental process of nature might be imitated by art, to the perfect preservation of animal substances. To discover *how*, occupied now his whole attention. At the end of some months, devoted to this pursuit, the happy thought flashed upon his mind, which was to lead him to the discovery of the desired secret. Compelled to return to Italy, by a dangerous malady brought on by nearly a week's exposure to an unwholesome atmosphere, in a pyramid of Abu-Sir, which he had entered for the purpose of extending his scientific researches, he was obliged to intermit for a time his favorite pursuit; but after regaining his health, he again gave himself to it with renewed ardor; and after a short time succeeded, to the highest degree of his most sanguine expectations.

The following are some of the results obtained by the discovery.

Entire animal bodies yield as readily to the process, as small portions. They become hard, taking a consistency entirely stony. The skin, muscles, nerves, veins, blood, &c., all undergo this wonderful change; and to effect this, it is not necessary to remove any part of the viscera. The color, forms and general characters of the parts remain the same. Offensive substances lose their smell. Putrefaction is checked at once. What is most wonderful of all is, that if the process be carried only to a given degree, the joints remain perfectly flexible. Skeletons even remain united by their own natural ligaments, which become solid, although they retain their pliancy. Moisture and insects never injure them. Their volume diminishes a little; the weight remains almost the same. Hair continues firm in its place, and retains its natural appearance. Birds and fishes lose neither their feathers, membranes, scales, nor colors. The insect preserves its minutest appendage. The eyes in most animals, sparkle as in life, and from their want of motion alone would you suppose vitality extinct.

The following are some of the objects, that have been subjected to the petrifying process, and are now exhibited in the studio of Sig. Segato. One of the first of his experiments, was performed upon a Canary bird, (Fringilla Canaria, Lin.) It is still preserved unaltered, although it is now ten years since the experiment was performed; and it has been submitted to the action of water and of insects. A parrot (Psittacus aestivus, Lin.) retains its original brilliancy of plumage, unimpaired. Eggs of the land turtle, turtles, various tarantulae, a water snake, a toad, various kinds of fish, snails and insects, are in a perfect state of preservation. To these, are added various parts of the human body. A hand of a lady, who died of consumption, preserves the emaciation of the disease and of death. Another of a man is flexible in the different phalangic articulations, and yet unalterable; a foot with the nails prefectly fast, a collection of all the intestines of a child, in their natural colors and forms, with the fecal matters unremoved; the liver of a man who died from intemperance, dark and lustrous like ebony; an entire human brain with its convolutions, of extreme hardness; the skin of a woman's breast, naturally configured; a pate of a girl perfectly flexible, from which the hair hangs in curls; the head of an infant partly destroyed, and discolored by putrefaction. There is also in the cabinet of Sig. Segato, a table constructed as follows. A spheroidal surface of wood contains a parallelogram, composed of two hundred and fourteen pieces, regularly arranged. These to the eye appear like the most beautiful pietre dure that have been produced by nature. Their various colors, polish and splendor, and their surprising hardness would leave no doubt of their stony character. The sharpest file, with difficulty, makes an impression on any of them; some it does not attack at all. These pieces are all portions of the human body, hardened by this new process; as the heart, liver, pancreas, spleen, tongue, brain, arteries, &c., &c., all resembling the most highly polished precious marbles. An entire body has not yet been tried, principally on account of the limited resources of Sig. Segato, although the expense would be but about one tenth of that of embalming by the ordinary process.

Great advantages to science, especially to natural history and human anatomy, are expected to result from this discovery; and

it is even confidently believed that the remains of friends, of men of science and of worth, may be preserved for ages in the exact form and appearance, in which the hand of death found them, with nothing offensive or revolting about them.

As vouchers for the accuracy of the statements contained in the pamphlet, the certificates of many of the distinguished physicians, professors and men of science in Florence, where Sig. Segato resides, are appended. Among them, it is sufficient to mention the names of Sig. Betti, Professor of Physiology; Sig. Zannetti, Professor of Human Anatomy; and Dr. Gazzeri, Professor of Chemistry.—[Am. Jour. Science and Arts.]

SUGGESTION IN CIVIL AND MILITARY SURVEYING.—NEW INSTRUMENT FOR MEASURING DISTANCES, ETC.

The following article from the United Service Journal, is well worth attention. The instrument there proposed, would not only be found useful in determining distances for the details of the topography of the surrounding ground—but we are convinced, that properly constructed, it can be applied to the nice measurement of all distances—as the instrument contains within itself a constant base line.

We have seen much of surveying instruments of every description, and have paid some attention to the comparative accuracy of different forms—and we do think that an instrument on this plan containing the means of *perfect* adjustment, (two or at most four adjustments would be required,) would measure distances from one to two thousand feet far more accurately than tapes, chains, or any of the usual instruments for lineal measurement.

Instead of a single straight edge, we would suggest a pair of them, forming a groove in which the support to the mirror should slide, and by making this support of considerable length we obtain a more accurate instrument, as the inclination of the moveable mirror would be less liable to variation.

The mirror might be moved by means of a long micrometer screw, and from this the reaching of the smaller posts might be made, instead of from a vermier, or even with it to operate as a check.

To fit such an instrument upon a tripod—to add the necessary apparatus for levelling, &c., would require but little ingenuity.

We intend having such an instrument made, and testing it rigorously—we shall then be enabled to speak from our own experience in the matter.

It is evident to every one that the distance of objects perfectly inaccessible may be obtained at one observation and reaching, it being only necessary to select a well defined line or object, as the branch of a tree or point of a rock.

The latter part of this article we have inserted with the view of showing that the measurement of distances by means of two wires in a telescope, &c., *is* (as we have always maintained) *no new discovery*, though we have seen an instrument on this principle, for which a patent was obtained, commendations given, praising in particular the novelty of the method, &c., and above all for which an exorbitant price was demanded.

We think any man can put two horizontal wires in his telescope, and use them as is detailed below, without fear of any one's patent right.

Several useful hints as to keeping record of levels, will be found at the end of the article. G. C. S.

"As the district occupied by the army of an enemy cannot be surveyed in the usual manner, excepting at imminent hazard to the officers engaged in the operation, the mode of doing so must be such as is employed for ascertaining inaccessible distances. Some of the most prominent objects of the country might very properly be laid down on the plan by triangles having large base lines; but it would be almost impossible to ascertain the position of objects of secondary consequence, not to speak of details, in this manner, as the angles would

be so multitudinous and confusing, as to defeat the end that was intended. To supply a remedy for this defect, many scientific persons have proposed to measure the distances of these minor objects from a minute base. All the plans, however, that have as yet been proposed are attended with great difficulty and trouble to the surveyor, as the base being invariable in its length, the instruments are required to be very delicate in their construction, so as to be able to measure very small differences in the angles of the triangles, and even after all the result obtained cannot be depended upon as to correctness. Sir David Brewster's telescope with the divided object glass is certainly less objectionable than most methods; but still the measurement of the base, together with the two adjustments of his instrument at every series of operations for ascertaining a distance, must be the means of wasting a deal of time, which is so precious to the surveyor in the field. If, however, the angles adjacent to the base were made *immutable*, and the base itself were lengthened or shortened, according to the distance of the object to be measured, the operation would then become much more expeditious, and it would be as easy to compute two or three miles as so many hundred yards.

The simplest method for carrying this principle into effect, is to fix securely (see figure in next page) on a straight edge, *a c*, a mirror, *a*, the face of which describes an angle of 45° with *a c*, and through the centre of which a part is left transparent, resembling one of the glasses of a quadrant or sextant, so as to allow the the object *b* to be seen by the observer, whose eye is supposed to be at *d*; *c* is another mirror, the face of which describes with the base *a c* an angle less than 135°, which is secured upon a square sliding along the edge of *a c*, which of course must be made as straight as possible. The square *c* may be moved along the straight edge *a c* either by a rack and pinion or by a shifting screw; *d* is a telescope similar to that of a sextant, only larger, so as to make the object *b* more distinct; *a c* is graduated as before stated, and a nonius scale is fixed upon the sliding square *c*. After having directed the telescope upon the object *b*, the square *c* is slid along *a c*, till *b* is reflected from the mirror *c* on that of *a*, and thence to the eye at *d*, causing the reflected object to coincide with the same as seen by the eye through the transparent part of the mirror *a*. The distance *a b* as indicated on *a c* is then read off, and either noted down in a field-book or pricked off immediately upon the plane table. If 1 foot along *a c* be made to represent 2000 feet along *a b*, then 1 foot of *a b* will be indicated by nearly the $\frac{1}{166}$ part of an inch, which is very easily read off with the assistance of a nonius, much more so than the minutes of a degree on a common theodolite, where it is usual to measure with the nonius the $\frac{1}{1500}$ part of an inch. An error, therefore, cannot easily be created in this operation; but a mistake is more likely to occur in an imperfect coincidence of the object with its image; the probability of which, however, would be greatly lessened through care and a little practice on the part of the observer. Some persons, however, may object to this instrument, on account of the great difficulty of constructing a perfect straight edge; but I have seen two made by Mr. Adie of Edinburgh, out of a common pit-saw, which could not in any part have deviated the $\frac{1}{4000}$ part of an inch from a right line, as when they were applied to one another, the light was completely intercepted by them. What has therefore been accomplished in one instance may be expected in another. Where, therefore, good workmanship has been displayed in an instrument, an *accurate observer* need not expect an error of more than about a foot in a mile, by my method of measuring inaccessible distances. Should a surveyor wish to take in a circuit of more than a mile in radius from one station, instead of having a long base, he would probably find it more convenient to have several supernumerary slides in the case of his instrument, each of which might have their mirrors so adjusted, as by their means to be able to measure 2000, 4000, and 8000 feet or yards of distance in 1 foot of the base *a c*. In this manner the length of the instrument need not exceed much more than two feet and a half, and would therefore be of a size far from bulky or unmanageable. An observation likewise might be taken by it quite as expeditiously as with a theodolite or sextant, so that far from its becoming an annoyance to a surveyor, in cases where very great accuracy in the plan of a country is not requisite, it might supersede the

use of not only the theodolite, but the chain likewise.

To exemplify the truth of this, let a be the station where a surveyor has fixed his instrument, the support of which may be a plane-table; b is the object whose distance from a the observer wishes to ascertain. Let $b\ a\ c$ be a right-angled triangle, of which the angles $b\ a\ c$ (a right angle) and $b\ c\ a$ are constant and invariable, whatever may be the distance of $a\ b$, $a\ b'$, $a\ b''$, &c. As the sides of similar triangles are proportional, $a\ c'$ will be to $a\ b'$ or $a\ c''$ to $a\ b''$, &c., as $a\ c$ is to $a\ b$. The observer has, therefore, merely to measure the base $a\ c$ which may be graduated in the same manner as a plane scale, so as to give the exact length of $a\ b$ in miles, yards, feet, or any other measure the surveyor may prefer. If therefore $a\ c$ be 1 foot in length, and the angle $b\ c\ a$ be previously so arranged by the mathematical instrument-maker, as to make the distance $a\ b = 1$ mile in length, 2 feet or twice $a\ c$ will show that the distance $a\ b'$ is exactly two miles, or if $a\ c''$ were six inches in length, the quantity $a\ b''$ would then be half a mile.

The celebrated James Watt proposed to measure distances, by means of a telescope fitted up with wires, as in the adjacent figure.

An assistant was to convey to any station, the principal desired, a staff graduated from a foot or so from the end resting on the ground, upwards into, say feet, tenths, &c. A vane with a horizontal line drawn upon it, which could be seen at a considerable distance through the telescope, was to be secured at zero on the staff, whilst another and a similar vane was required to slide along the staff at pleasure. The surveyor was to fix the nether wire b of his telescope upon the lower vane, whilst he directed the assistant by signals to raise or depress the moveable one, till it coincided with the upper wire a. The staff was then to be taken to him by his assistant, and the distance, as shown by the upper vane from the lower one, was to be noted down in the field-book as that between the two stations. The Edinburgh Philosophical Journal states that by this method Mr. Watt surveyed part of the line of the Caledonian canal previously to its formation. Much time would be saved by dispensing with the vanes, and having the graduation on the staff made sufficiently dtstinct, as to be legible through the telescope at a considerable distance, say 2000 feet. I have actually measured distances in this manner, which were wonderfully correct. But the great objection to Mr. Watt's method is the loss of time which occurs in waiting till the assistant has removed the staff from one station to another, as well as the great liability the surveyor undergoes of having his directions misunderstood. This principle, however, might very safely be employed, in measuring the distances between one station and another, in the operation of levelling, so as to act as a check on the person who has the management of the chain, particularly when crossing a ravine, where the assistant is apt to become negligent in his measurements. The telescope of the level might be fitted up with additional hairs, so as to subtend, *if possible*, 2 feet of the staff in 100 feet of the distance. In that case, however, the surveyor would be under the obligation of fixing his instrument in the line of the levels, which would not otherwise be necessary.

As I have adverted to the subject of levelling, it may be as well to state, that I have found it very convenient to have one side of the staff graduated black on a white ground, and marked 1, 2, 3, &c., feet and tenths from the bottom; whilst on the reverse side the graduation is made with *red*

paint on a white ground, but numbered 3, 4, 5, &c., beginning from a distance of *seven and a half tenths* of a foot from the end which rests on the ground. By the two sides of the staff, a very different number representing the height of the ground is obtained, that from the latter side being constantly 225 feet higher than what the other indicates. An error in the levels can thus by a single glance be detected, as the quantities read off being so wide of each other, the memory no longer acts disadvantageously in a repetition of the observation. Instead, therefore, of being obliged to recommence the levels from the outset, when a surveyor suspects an error to have taken place, he would merely proceed to that part where his observations did not correspond, and not only time would be saved by his adopting these checks to his work, but he would acquire such a confidence in it that nothing could destroy. HENRY E. SCOTT.

From the Railroad Journal.

RADII OF CURVES, ACCLIVITY OF GRADES, RATES OF SPEED, ETC.

To the Editor of the Railroad Journal:

Sir,—It was not until very recently, that I discovered in your Journal of February 13th, a communication signed S. D., in relation to the report of James Seymour, respecting the radii of curves, acclivity of grades, rates of speed, &c., of the different Railroads between Washington and New-York, and the Roads in the vicinity of the latter city. I entirely agree with S. D. in saying that the natural features of the country must govern the course of the route, nor would I be understood to say that the radii of curves were no detriment to such a work as the New-York and Erie Railroad; but on the contrary, I consider these things serious obstacles in the way of Internal Improvement, and might be carried to such an extent as to work a complete failure of the purposes intended by them. If the surface should prove to be a perfect plane, as S. D. says, I confess there would be but little to contend against, and in such case the service of an engineer would hardly be required. But he admits that this is not often the case, and that the surface is more or less broken—that the topography of the country is undulating, with vallies and ridges often running contrary to the course that we would wish them. It is frequently the case that spurs run out so that engineers are obliged to cut through them, and place the earth in the vallies or low ground contiguous. This, of course, must enhance the expense, yet it is often better to do this than to curve around them, if the radius is likely to be short, and the grades light. But where the curves can be made with a large radii, and the grades are heavy, engineers should, by all means, avoid these jutting points by curving around them. This increases the distance, but this objection is overbalanced by lessening the cost, and also lessening the grades. This engineers are often compelled to do in this country, and on the route of the New-York and Erie Railroad, great pains have been taken to avoid curves of small radii, so much so that in many instances the expense has been greatly increased to effect this object. Speaking for myself, I have not located one foot of ground with a radius of less than 955 feet, and think to have one cotinnued line of over 60 miles with a curve of no less radius, although with a radius of from 400 to 600 feet, I could have wound round hills, and kept the grade near the surface, whilst, with the radius of 955 feet, the grade line must often pass so as to make the cutting much greater and the embankment much more heavy.

Equal pains have also been taken to lessen the grades by keeping well upon the side hills,—by crossing deep ravines,—and by causing excavations of ten, fifteen, twenty, and sometimes over thirty feet,—whilst, if a sharp grade were no detriment, we could follow near the streams, and would lessen the expense; but the grades in these instances, would, at times, be quite easy, and in other places very heavy. The engineers have chosen and acted upon the course of making the grades as regular as possible,—which course will stand the test of review. Knowing, or at least believing, that many will view this magnificent work (the largest and most noble of the kind in the United States,) its engineers would in all time to come, regret that it should not

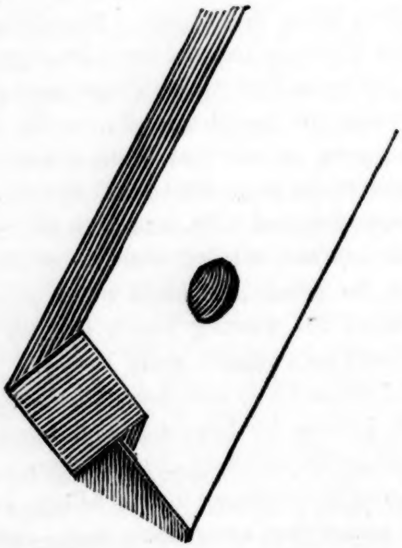
be completed in a workmanlike manner, or that permanent injury should result to the Company or the public, from their incapacity, especially with one so eminent in his profession as Judge Wright at the head.

As S. D. says his motive in adverting to Mr. Seymour's letter, is a desire to see the Lake Erie Railroad finished, as regards route and details, as perfect as circumstances will permit, the Company are doubtless obliged to him for his friendly feeling towards their Road, and in behalf of the Engineers I invite him to an inspection of the same as soon as they shall have so much of it completed as he may consider worthy his attention.

One of the Engineer Corps of the
New-York and Erie Railroad.

From the Railroad Journal.

NEW MODE OF JOINING THE PLATES OR BARS USED UPON RAILROADS.



Montgomery, Alabama, March 28th, 1836.

Sir,—Enclosed I send you five dollars—my amount of subscription for the current year.

I also send you a drawing of a new mode of joining the plates or bars used upon Railroads, together with an extract from the specification of a patent, applied for by me, for the same—which, should you think it worthy a place, I should be pleased to see in the columns of your journal.

Very respectfully,
Yours, &c.
A. M. McCaine.

EXTRACT:

"The surface of the bar may be either rounded or flat—a plain plate, or flanged on the inner edge, or otherwise, as preferred, and of any required thickness, width, and length. The joint or connection, which I claim as new and original, I make with a double lap or bevel; that is to say, two bevels or laps in contrary directions, of equal or unequal width of surface on the end of each plate, in such manner that one part of the bar or plate laps *above*, or over, a part of the connecting bar or plate, while the other part falls *below*, or under a corresponding part of the same connecting bar.

"In the drawing, the bevel or lap is represented of equal widths upon the end of the plate, each bevel being made in contrary directions, at an angle of 45°, which angle may be found most advantageous in practice. And where greater solidity in the extremity of the joint is required, instead of a plane surface, or "bevel," I use a convex and corresponding concave surface—the point, or centre, from which said curved surface is described, being upon the upper edge of the plate or bar.

"The bevels or laps are of the same width and angle on the connecting plate, but inverted in position, so as to make a perfect joint both laterally and longitudinally, when applied to the preceding plate: so that all the plates having the ends thus bevelled or lapped, and laid down continuously upon the bearing surface, may be *confined down* by one spike in the centre of each bar or plate; and it is evident that the plates or bars may be permanently fixed with a fewer number of spikes than is necessary with the ordinary methods of joining.

"I also claim the application of this principle of the double lap or bevel, to a *mitre* joint and *tongue* joint, or to any other joint by which the bars thus *confine each other*, when placed in connection.

"Any one at all acquainted with the practical operation of Railroads, must at once appreciate the advantages of this expedient, by which the subscriber conceives they may be effectually secured from all difficulties arising from the working loose

of the end spikes, and consequent rising of the extremities of the plates—which coming in collision with the wheels and axles of the engines and cars, give rise to serious accidents, endangering the lives of passengers, and causing frequent and expensive damages to the locomotives.

"With this joint, even should the end spikes work out, or break off, there can be no vertical or lateral separation of one bar from another—and, consequently, no injury can arise from such cause. The great and perpetual expense attending the keeping up of supervisors of the iron, on a long line of Railroad—now found absolutely necessary to prevent injuries and accidents from loose bars—would be entirely obviated. A great saving in the annual expenses of the road would be thus effected; and the trips could be performed with more celerity and regularity, and the passengers would pass over the road without that constant apprehension of danger, which the prospect of loose bars, broken spikes, and raised plates, is so well calculated to awaken."

I approve very highly of the above plan of joining rail plates, and shall adopt the same on the Montgomery Railroad.

ANDR. ALFRED DEXTER,
Civil Engineer.

March 28, 1836.

Albany, N. Y., April 5, 1836.

To J. E. BLOOMFIELD, ESQ.

Dear Sir,—In answer to your note of the 2nd inst., requesting me to give you the result of some experiments made by me with Locomotive Engines on planes of different degrees of elevation, I beg leave to hand you the following extract from a report recently made to the Directors of the Castleton and West Stockbridge Railroad Company, including four tables, exhibiting the load that different engines will draw at the same speed with working wheels the same diameter, and the load they will draw at different velocities, and also the load they will draw with different sized working wheels. Very Respectfully,

Your Ob't. Serv't,
WM. H. TALCOTT,
Civil Engineer.

"In order to answer the next question, viz. What will be the cost of the requisite shops, depots, carriages, wagons, and motive power, it will be necessary to determine how much load an engine will draw at one time up the different grades adopted in the estimate. The following tables, computed from experiments heretofore made on plans of different degrees of inclination, will enable us to determine this point with great accuracy.

The experiments were made on a straight road, and with the rails in full order.

The *first* column in each *table* shows the velocity in miles per hour; the *second*, the ascent in feet per mile; and the *third*, the gross load in tons which the Engine will draw at one time."

[We understand that the experiments to test make out the following tables, were made on the Hudson and Mohawk Company, they are certainly very interesting We are much obliged to Mr. Talcott, for giving them to the public. The engines on the Hudson Railroad, are not as powerful, nor have they the improvements lately introduced, as far as we are informed, as the Engines constructed in Baltimore and Philadelphia.—ED.]

I. ENGINE 8½ TONS. Working Wheels 4 ft. diam.			II. ENGINE 10 TONS. Working Wheels 4 ft. diam.		
Velocity in Miles per Hour.	Ascent in Feet per Mile.	Gross Load in Tons.	Velocity in Miles per Hour.	Ascent in Feet per Mile.	Gross Load in Tons.
16	0.00	97	16	0.00	116
16	10.	66	16	10.	79
16	20.	50	16	20.	60
16	30.	40	16	30.	48
16	40.	33½	16	40.	40
16	50.	29	16	50.	34½
16	60.	25½	16	60.	30½
12	0.00	116	12	0.00	139
12	10.	78½	12	10.	94½
12	20.	59½	12	20.	71½
12	30.	48	12	30.	57½
12	40.	40	12	40.	48
12	50.	34½	12	50.	41
12	60.	30	12	60.	36
8	0.00	139½	8	0.00	167½
8	10.	94½	8	10.	113½
8	20.	71½	8	20.	86
8	30.	57½	8	30.	69
8	40.	48	8	40.	58
8	50.	41½	8	50.	49½
8	60.	36½	8	60.	43½

III. Engine 8½ Tons. Working Wheels 3 ft. diam.			IV. Engine 10 Tons. Working Wheels 3 ft. diam.		
Velocity in Miles per Hour.	Ascent in Feet per Mile.	Gross Load in Tons.	Velocity in Miles per Hour.	Ascent in Feet per Mile.	Gross Load in Tons.
16	0.	108½	16	0.00	130
16	10.	73½	16	10.	88½
16	20.	59	16	20.	67
16	30.	45	16	30.	54
16	40.	37½	16	40.	45
16	50.	32½	16	50.	39
16	60.	28½	16	60.	34
12	0.00	130	12	0.00	155½
12	10.	88	12	10.	105½
12	20.	66½	12	20.	80
12	30.	53½	12	30.	64½
12	40.	45	12	40.	54
12	50.	38½	12	50.	46
12	60.	34	12	60.	40½
8	0.00	187	8	0.00	225
8	10.	127	8	10.	152½
8	20.	96	8	20.	115
8	30.	77½	8	30.	93
8	40.	64½	8	40.	77½
8	50.	55½	8	50.	67
8	60.	49	8	60.	58½

ON THE COMPARATIVE VALUE OF IRISH AND VIRGINIAN TOBACCO. BY EDMUND DAVY, F. R. S., M. R. I. A., &C., PROFESSOR OF CHEMISTRY TO THE ROYAL DUBLIN SOCIETY.

In the year 1829–30, the cultivation of tobacco in Ireland excited much attention among agriculturists, and several hundred acres of it were raised in different counties; in consequence, the attention of the Royal Dublin Society was directed to the subject, and the author was requested by a select committee of that body to institute experiments on tobacco, with a view to determine some questions of a practical nature, as whether its root contained nicotin, and in what quantity, and to ascertain the comparative value of Irish and Virginian tobacco.

The author's experiments were made on average samples of Virginian and Irish tobacco; for the former he was indebted to the kindness of Mr. Simon Foot, and for the latter to Messrs. Wild, Cuthbert, Cathwell, and Brodigan. From a number of experiments, the author was led to conclude, that the dried roots of Irish tobacco contain from four to five parts of nicotin in 100 parts; and that one pound of good Virginian tobacco is equivalent in value to about twenty-four pounds of good Irish tobacco.

After the author had finished his experiments, it was gratifying to him to be informed that some manufacturers estimate one pound of Virginian tobacco equivalent in value to about two pounds of Irish. Hence there seems to be a pretty near coincidence between their results and those derived from a chemical examination.—[Proceedings of the British Association: Lond. and Edinb. Phil. Mag., vol. vii., p. 391.] A. T.

Slate Floors.—The following notice from the London Penny Magazine, will probably be the means of introducing a new and valuable article for floors, for stores, factories, shops, &c., which possesses the advantage not only of durability, but also of *incombustibility;* and must therefore, we think, come into common use.

With a view of testing its advantages, an enterprising gentleman, who is an advocate for (not in the *common* acceptation of the term, but in *reality*) "fire proof buildings," has ordered several hundred tons of the article from England, to be laid in stores *now* erecting, and soon to be commenced by him.

Slate.—Experiments have been made to ascertain the applicability of slate to other uses than the covering of houses. The result has been the discovery that, as a material for paving the floors of warehouses, cellars, wash-houses, barns, &c., where great strength and durability are required, it is far superior to any other known material. In the extensive warehouses of the London Docks it has been used on a large scale. The stones forming several of the old floors, having become broken and decayed, have been replaced with slate two inches thick; and one wooden floor, which must otherwise have been relaid, has been cased with slate one inch thick; and the whole have been found to answer very completely. The trucks used in removing the heaviest weights are worked with fewer hands. The slabs being sawn, and cemented closely together, as they are laid down, unite so perfectly, that the molasses, oil, turpentine, or other commodity which is spilt upon the floor, is all saved; and, as slate is non-absorbent, it is so easily cleaned, and dries so soon, that a floor upon which sugar in a moist condition has been placed, may be made ready for the reception of the most delicate goods in a few hours. Wagons or carts containing four

or five tons of goods, pass over truck-ways of two-inch slate without making the slightest impression. In no one instance has it been found that a floor made of sawn slate has given way; in point of durability, therefore, it may be considered superior to every other commodity applied to such uses. The consequences of this discovery have been, that full employment is found in the quarries which produce the best descriptions of slates, and that additional employment has been given to the British shipping engaged in the coasting trade.—[From a Correspondent.]

From the Railroad Journal.

LOWELL, MASSACHUSETTS.

No. I.

By Henry Colman.

A recent visit to Lowell, Mass., has affected me with much surprise, and afforded a high gratification. Agriculture and Manufactures have often been denominated, and without any poetical fiction, twin sisters; their interests are so intimately interwoven with each other; in their operations, relations and success, they are so immediately dependent on each other, that I trust it will not be deemed foreign from the proper objects of the New-York Farmer, if I give some little account of this extraordinary place. Extraordinary it may well be called, for here is a city at its maturity at the age of twelve years; here is a spot which seemed almost doomed to perpetual sterility, teeming with wealth; and in that short space the residence of a few straggling farmers, gathering, by severe toil, a scanty subsistence for themselves and their cattle, from an uncongenial and pernicious soil, is transformed into a busy and buzzing hive, with a population approximating twenty thousand, active with the impetuous spirit of industry, stimulated by rapid returns of profit, taxing to its utmost speed all the powers of mechanical genius, and labor-saving art; and with a thirst for knowledge and improvement, which seems to gather quickness from sympathy with the movements of the machinery around them, erecting halls, labaratories, libraries, and cabinets, for the cultivation of science; and thus laying a broad foundation for intellectual improvement.

The moral spectacle here presented is in itself beautiful and sublime. The machinery of one of these great mills is not an unapt picture of society. Here are wheels within wheels; bands circling within bands; threads crossing threads; numerous and almost infinitely varied operations going on at the same time; much that is seen, and much that is unseen; mighty and concealed powers working in their subterraneous abodes with a tremendous agency, and sending out their influences to places far remote from their presence; human ingenuity strained to its utmost power, and human care equally concerned in the constant superintendence of this complicated apparatus; the powers of the physical world called into efficient action, moulded, guided, and brightened under the sharpened activity of intellect; the moral every where intermingling in order to preserve harmony and secure the fidelity of the intellectual and physical powers; and all, in all its parts and operations, all resting upon an unseen agency, whose activity is every where detected, but whose power is utterly unmeasured, and the mode of whose operations the brightest philosophy has not even conceived; all resolvable into one simple and great law, the law which pervades the whole material creation; holds fast the dust of the balance, the atom floating in the sunbeam, and the mightiest orb which brightens in the firmament; all, where each part retains its place, performs its duty and supplies its contribution, moving on in a beautiful harmony; producing results largely subservient to human comfort, improvement and pleasure. On the other hand, all these results are defeated, when even the most minute and the humblest part of the machinery fail to perform their proper office; determine to go wrong, or refuse to go at all; when the wheels cease to revolve, or the filaments become broken; or the combination of physical, intellectual and moral energy, felt in a thousand hands, beaming from a thousand eyes and operating in a thousand hearts, is broken up, withdrawn, relaxed or perverted. Now, this is a striking analogy of human society; this is a world in miniature. Laws bearing a strong resemblance to each other prevail in both. They are universal laws;

they are uncontrolable and unalterable to human power or pleasure; they are ceaseless in their operation; and, like the great Being who established them, they are 'without variableness or even the shadow of change.'

Lowell is principally devoted to the manufacture of cotton; but it embraces several other important factories; very extensive woolen factories, for flannel, broadcloth, kerseymere, worsted and carpeting; extensive machine shops for the construction of various kinds of machinery, from that necessary to the furnishing of a cotton mill to railroad cars and steam engines; together with a card and whip factory, planing machine, reed machine, grist and saw mills, glass works, iron furnace and powder mills, and extensive bleacheries and print works; in all, employing a population of nearly eight thousand operatives, to say nothing of the persons subsidiary to their support and accommodation, and a capital of nearly nine millions of dollars.

The mills in general are of a large size; generally of brick, and seven or eight stories in height, well lighted, ventilated, and warmed. The machinery seemed of the most improved and perfect kind; and in general, and as far as the nature of the occupation admitted, the neatness and order of the mills which I visited, most exemplary. The hours of work, exclusive of meals, average about twelve; and, as far as I could learn, it was the determination of the overseers never to employ children under twelve or thirteen years of age; and none such were employed, except where parents, as in the block printing, where they work by the piece, chose to avail themselves of their children's aid in some of the subordinate operations. These cases were almost universally those of foreigners. They were discountenanced by the superintendents; and in my opinion, where there are schools to which such children might be sent, it ought to be made a penal offence by the statute; or in any event never more than three hours' labor in the twenty-four should be exacted from them.

The cotton fabrics made here are of various qualities; the finest averaging about 42 or 45 hanks to the pound. The printing establishments, by means of engraved copper cylinders, where sometimes four impressions are given by a single revolution of the machine, are well worth visiting; and the machinery for engraving these cylinders by the sinking of steel dies is very curious, and capable of being graduated to the thirty-six thousandth part of an inch. This is almost literally splitting a hair. The invention and delineation of the figures displayed great ingenuity and skill. The shearing of the woolen fabrics is a delicate and beautiful operation; but the singeing of the fine furze or nap of the cotton cloth by dragging the piece of cloth directly over, and in contact with, a red hot iron cylinder without burning the cloth itself, strikes an unaccustomed eye with extreme astonishment. The card and whip factories are exceedingly curious and as automatic machines approach nearer, to the actual operations of intellect and intelligence than any one, who had never seen them, could imagine to be possible. Both these machines, we understand, were of domestic invention. The rapidity of the operations in almost every department of manufacture which I visited was a remarkable circumstance. A large whip was completely braided with cord in about five minutes; and the superintendent of one of the establishments informed me that he turned out one piece of cotton cloth of thirty yards in about every minute and a half while his works were in full operation.

The standard of health among the operatives in the factories, as I learnt from the best medical sources, was considered as good. Many persons, on going into a new place, and into new and different employment from that to which they have been accustomed, generally suffer at first, and pass through a kind of acclimation; but afterwards they enjoy as good health, and in some cases the health has been improved, as before entering the mills. It is obvious, however, that some of the processes must be less favorable to health than others; as there are, doubtless, predisposing causes to disease in some, which do not exist in other temperaments or constitutions.

Of the moral character of the present manufacturing population of Lowell, I feel

authorized to speak in high terms. I was permitted to look in some cases at the books, in which the names of the individuals employed are recorded; and if they are discharged, the causes of that discharge are mentioned. The instances of discharge for improprieties of conduct were comparatively very few. The regulations for enforcing decorum and order are strict; and the character of the present superintendents of these establishments, such as to afford an ample guarantee that all which can be done shall be done to secure the good conduct and virtue, and to promote the comfort of the young persons under their employ. These gentlemen, acting with such a powerful influence as they necessarily exert, it is obvious, hold a highly responsible situation. The virtue and welfare of many thousands of very susceptible beings rest upon what they do or what they fail to do: and as long as they rate the value of moral character so highly, and insist upon moral correctness, as indispensable to their patronage, and encourage sentiments of high self-respect among the operatives themselves, they certainly will do much towards securing the moral purity, and advancing the moral improvement of these interesting communities. It was delightful on Sunday morning, at the first sound of the bell, to see the multitudes of well-dressed young people crowding into the Sunday School, and into the house of God; and it was a circumstance of peculiar gratification to learn, that more than three hundred of these young persons were communicants at one of the churches in that town. The congregating of such vast numbers of young people, removed in general from the restraints of home, presents, it cannot be denied, great perils to virtue. The manufacturing districts of old countries have long been stigmatized as places of most flagrant licentiousness and immorality. The character of our population is essentially different from that of the places referred to. Our manufacturing population have in general had the advantages of careful domestic training, and a good school education. They are not manufacturers or life; but design to remain only long enough in the mills to get the means of a settlement in life. They have undoubtedly, the greater part of them in New-England, been blessed with a religious education; and they are looking forward to rise in life, and feel the high worth and indispensable importance of character every where among us. These circumstances cannot fail to operate most favorably among them; and their beneficial effects are instantly to be seen. Whether they will remain sufficient will be matter of just concern with every benevolent mind.

Much is done likewise for their intellectual improvement. Frequent and most valuable courses of scientific lectures are given,—to which access is made easy by the payment of a very small fee. A social library and reading room are established likewise, on the most liberal principles; and a chemical laboratory, and a splendid mineralogical cabinet have been procured. We have never been in a community where the spirit of inquiry seemed more active, or found more patronage and encourgement.

Add to all this, that great instrument of virtue, of comfort, and of the amelioration of the condition of the poorer and laboring classes, the savings' bank, is in full operation among them; and here, as in every case where it has been tried, has produced the most salutary effects; the deposits already amount to $200,000, and promise to be greatly extended—a great proportion of the depositors being found among the young women engaged in the establishments. The perfect security of the wages of labor, is among the most efficacious protections of human virtue; and a powerful encourager of industry, frugality, and temperance—virtues so important to individual character and comfort, and to the general welfare of society.

I shall subjoin to this a statistical account of the Lowell manufactures, showing, in extensive detail, the condition of these establishments on the 1st of January of the present year,—a document well worth examination.

H. C.

March, 1836.

STATISTICS OF LOWELL MANUFACTURES, JANUARY 1, 1836, COMPILED FROM AUTHENTIC SOURCES.

Corporations,	Locks and Canals.	Merrimack	Hamilton.	Appleton.	Lowell.	Suffolk.	Tremont.	Lawrence.	Middlesex.	Boott Cotton Mills.	Total.
Capital Stock,	600,000	1,500,000	900,000	500,000	500,000	450,000	500,000	1,200,000	500,000	1,000,000	7,650,000
Number of Mills,	1	PrintW'ks, &c., 5	PrintW'ks, &c., 3.	2	Cotton and Carpet Mill in one building.	2	2	5, another or bleachery preparing.	2, and Dye House.	4	27, exclusive of Print Works, &c.
Spindles,		35,704	19,456	11,776	5,000 Cotton, besides Woollen.	10,752	11,520	31,000	4,620	Two going into operation, and two to be erected the ensuing season.	129,828
Looms,		1,253	560	380	142 Cotton, 70 Carpet.	348	404	910	38 B'cloth, 92 Casim'e.		4197
Females employed,		1,321	780	470	325	460	460	1250	350		5416
Males,	300	437	200	65	150	70	70	200	185		1377
Yards made per week,		184,000	85,000	100,000	2,500 Carp. 150 Rugs, 55,000	90,000	125,800	200,000	6300 Cas'e, 1500 Broadcloth.		849,300
Bales Cotton used in do.		120	75	95	76	86	90	180	None.		732
Pounds Cotton wro't in do.		44,000	28,000	33,000	30,000	30,000	34,000	64,000	600,000 lbs. Wool p. an. &3,000,000 Teasels.		263,000
Yards dyed and printed do.		163,000	70,000	None.	None.	None.	None.	None.			233,000
Kinds of Goods made,	Machinery. Cars and Engines for Railroads.	Prints and Sheetings, No. 22 to 40.	Prints and Drillings, No. 14 to 40.	Sheetings and Shirtings, No. 14	Carpets, Rugs, and Negro Cloth.	Drillings, No. 14.	Sheetings and Shirtings, No. 14.	Printing Cloths, Sheetings and Shirtings, No. 14 to 30, 34 to 41 in. wide.	Broadc'ths and Cassimeres.		
Tons Anthracite Coal expended p. an.		5,200	2,000	300	180	294	329	650	500		9453
Cords of Wood per annum,		1,500	1,500		500	70	60	60	1000		4690
Gallons of Oil, "		8,700	6,000	3,375	Olive 3000, Sp'm 4500.	3,840	3,692	8217	Olive 11000 Sp'm 2500.	-	54,824
Diameter of Water Wheels,	13	30	13	13	13	13	13	17	17 & 12	17	
Length of do. for each mill,	14	24	42	42	60	42	42	60	46 & 21	60	
Incoroprated,	1792	1822	1825	1828	1828	1830	1830	1830	1830	1835	
Commenced operations,	182	1823	1825	1828	1828	1832	1332	1833–4	1830	1836	
How warmed.	Hot Air.	Hot Air Furnace.	Hot Air Furnace.	Hot Air Furnace.	Hot Air Furnace.	Hot Air Furnace.	Hot Air Furnace.	Steam.	Wakefield Furnace & Steam.		

REMARKS.

Yards of cloth made per annum,	44,163,600
Pounds of cotton consumed,	13,676,600
Assuming half to be Upland and half New-Orleans and Alabama, the consumption in bales, averaging 361 lbs. each, is	38,000

A pound of cotton averagieg $3\frac{2}{10}$ yds.

100 pounds of cotton will produce 89 pounds of cloth.

As regards the health of persons employed, great numbers have been interrogated, and the result shows, that six of the females out of ten enjoy better health than before being employed in the mills,—of males, one half derive the same aduantage.

As regards their moral condition and character, they are not inferior to any portion of the community.

Average wages of females, clear of board,	$2.00 per week.
Average wages of males, clear of board,	80 cts. per day.
Medium produce of a loom on No. 14, yarn,	38 to 49 yds. per day.
Medium produce of a loom on No. 30,	25 to 30 " " "
Average per spindle, $1\frac{1}{10}$ yard per day,	
Persons employed by the Companies are paid at the close of each month.	
The average amount of wages paid per month,	$106,000
A very considerable portion of the wages is deposited in the Savings Bank.	
Consumption of starch per annum,	510,000 lbs.
Consumption of flour for starch in the mills, print works and bleachery, per annum,	3,800 bbls.
Consumption of charcoal, per annum,	500,000 bushels.

To the above named principal establishments may be added, the extensive powder mills of Oliver M. Whipple, Esq.; the Lowell bleachery ; flannel mills ; card and whip factory ; planeing machine ; reed machine ; grist and saw mills—together employing about 300 hands, and a capital of $300,000. And in the immediate vicinity, glass works, and a furnace supplying every description of castings. Also, a worsted mill, formerly the Hurd Woollen Mill, under the direction of Mr. M. H. Simpson. operates 1,200 spindles, employs 125 persons, consumes 1,000,000 lbs. of wool, and 11,250 gallons of oil per annum.

The locks and Canals machine shop, included among the 27 mills, can furnish machinery complete for a mill of 5,000 spindles in four months, and lumber and materials are always at command, with which to build or rebuild a mill in that time, if required.

J. K. SMITH'S SELF-ACTING BRAKES FOR RAILROAD CARS.

The subscriber has taken out Letters Patent for the principle of applping power to brakes by the motion or impetus and collision of cars on Railroads. Desirous of bringing the subject before the public, he has prepared drawings for the American Railroad Journal, explanatory of three modes in which the principle can be applied.

He is aware that the apparatus must vary according to the construction of the car, and leaves further explanation, believing that those interested will be able to make a suitable arrangement.

He flatters himself that he has, by this discovery, added something to the safety of Railroad travelling, to say nothing of the saving that will be made in attendance and the destruction of cars and machinery incident on Railroads. He hopes that this improvement will claim the attention of persons engaged on Railroads, inasmuch as every possible security, by means of brakes, is attained, and that instantaneously—without the aid of any attendant. Indeed, in many cases, accidents occur so unexpectedly, that the mischief is done before any agent can act—but by this means, action is immediate, and takes place equally on all the cars.

I feel the more confident of success, as there is nothing complicated or expensive.

Any communications addressed to the subscriber at Port Clinton, Schuyl. Co., Penn., will meet with prompt attention.

JOHN K. SMITH.

Description of the Drawings.

Fig. 1 represents a part of the frame of a tender ; and

Fig. 2 the ground frame of a coach with 4 wheels, 2 axles, 8 brakes, and 2 slides, *all inverted*. For the sake of distinction, I will call the large slide [*a*] the propelling

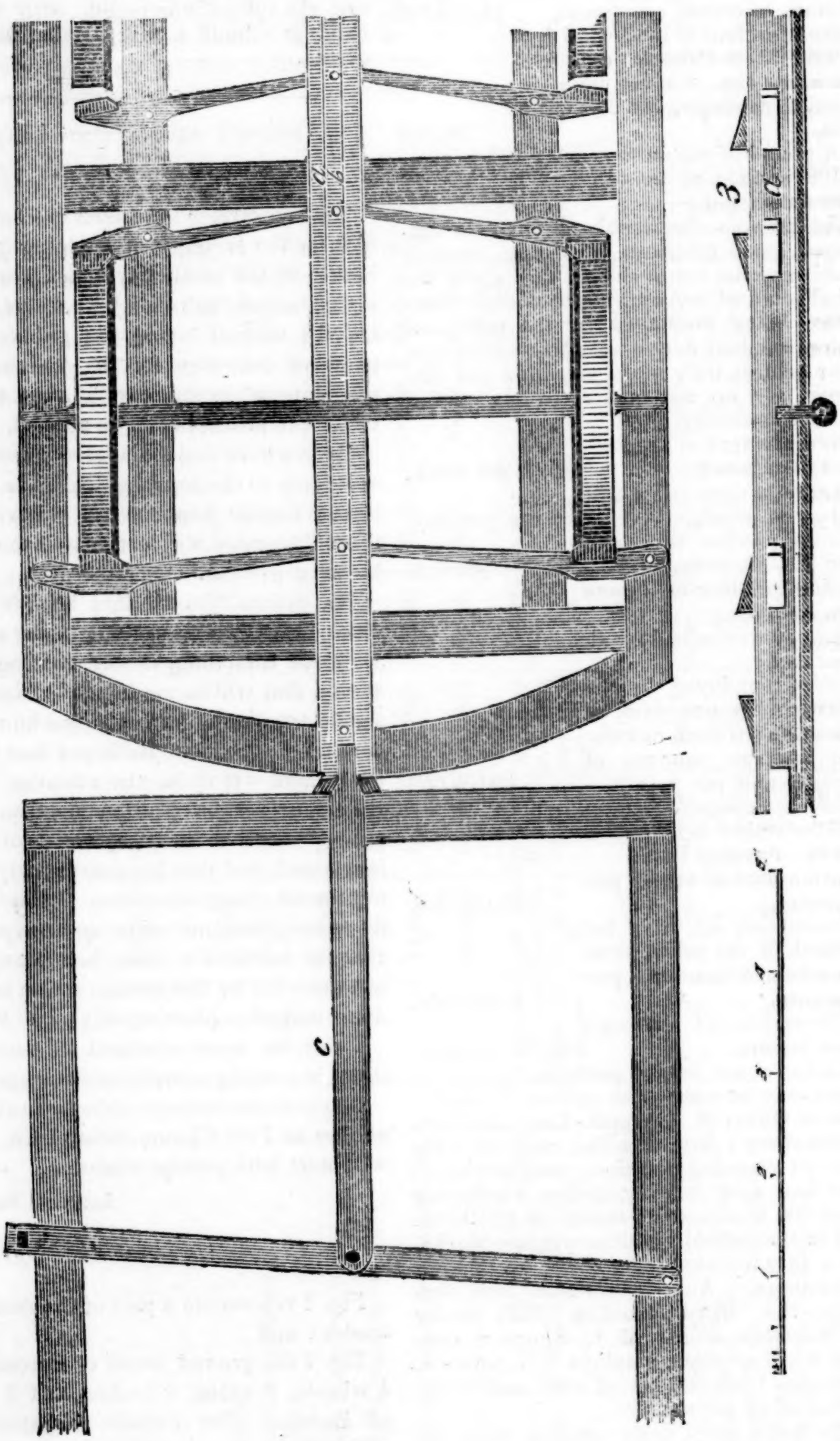


Fig. 2.

Fig. 1.

slide, and the small one [*b*] the adjusting slide. Fig. 3 shows the side view of the two slides. In order that the adjusting slide can be more easily moved, when there is a long train, it can operate over rollers supported from the large slide.

The levers of the brakes meet in the grooves of the propelling slide. Through the end of the levers a pin passes, which is secured to the adjusting slide ; there being a groove in the under part of the large slide, so as to admit of a motion of the pins of (say) 4 inches, carrying with them the levers of the brakes.

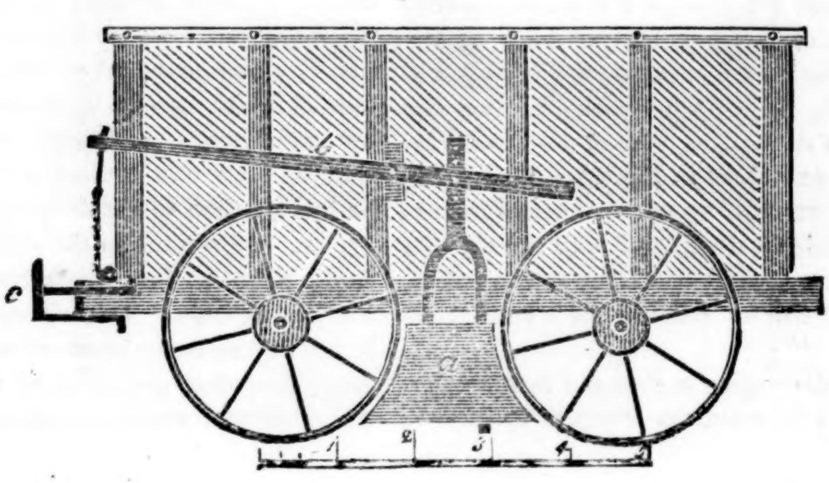
The propelling slide is coupled to the tender *without any play, but* the cars *must* play along the slide (say) 4 inches.

The adjusting slide, being immediately under the other, is coupled to the slide *c* on the tender, which is to have a shifting motion by means of lever *d*.

The whole drawing represents the slides properly attached, with the cars pressing forward on the slides, and the two front wheels locked, the cross lever *d* being secured to its place by an upright *hand* lever, *not* shown in the drawing. Now give the engine motion, and *both* slides will be drawn forward 4 inches, when the checks on the large slide will come in contact with the cross pieces of the cars, which move the cars ; by this motion the brakes are thrown from the front wheels, and the other brakes thrown towards the hind wheels, *but not* against them, and consequently the whole train is ready for running. Now, in order that the engine can run her train back, all that is necessary *is to* relieve the hand lever on the tender, and give motion to the lever *d*, by which the adjusting slide is operated upon—carrying with it all the brakes on the cars ; by this motion the brakes will be relieved from the *foremost* wheels, *during a retrograde motion*, and will not be thrown against the hindmost wheels, inasmuch as it would require the forward motion of the large slide to effect this ; suffice it to say, that when the engine is to proceed, lever *d* must be secured by the hand lever in the position it is now in (as shown in the drawing), and when a retrograde motion is necessary, relieve it and give it a forward motion, which can be done by the engineer or his attendant, without the least inconvenience. I do not think it necessary to show that each car in the train would be operated on equally, and I believe it equally superfluous to enter into any explanation to show that precisely the same effects would be produced at either end of the train—*this will be the case*, and that without any alteration of the fixtures, save that of detaching the engine from one end of the train, and attaching it to the other ; in like manner.

It must be borne in mind, that the cars are not attached to the tender in any other way than by the slides, except it be by a loose coupling ; the cars must recede from, and approach the engines (say) 4 inches, while the propelling slide must remain firm in its place. The cars may be coupled to

Fig. 4.



each other to prevent any one of them pressing forward on the brake, occasioned by any imperfection in the road or otherwise ; *thus* it will appear that while the engine is exerting the least amount of power the brakes are free from the wheels. It will also be seen that when the engine is impeded, the brakes must take instantaneous effect, produced by the impetus of the cars —*and* that it is in the power of the engineer to relieve the wheels of the brakes.

In the accompanying drawing it will be seen that two wheels (the foremost) will be operated on by two brakes each, while the other two will remain free—on account of the long and short brakes, but if it should be thought best, one brake can be thrown against each wheel, by having them either all long or all short, and of *course* the pins andt he grooves in the propelling and adjusting slides must be made to suit.

Fig. 4 is a plan for a vertical brake, such as is used for the coal cars on the Little Schuylkill Railroad.

The cars are coupled with chains allowing them a play of about one foot. *a* is the brake ; *b* the lever ; and *c* the slide. In case of a stoppage, the cars run together, and drive in the slide which applies the brake to the wheels.

The inventor gives this as but one of the many modifications of his brake.

Fig. 5 represents a car and tender coupled loosely with a play of one foot, though this may be greater or less.

When the engine is impeded, the slide *a* on the front car will come in contact with *c* on the tender, and apply the brakes—the slides on the different cars will come in contact with each other, and so long as the press of the cars continues, the wheels will be locked. If it is necessary to free the wheels of the brakes, give motion to the lever *d* (as explained in Fig. 1). The spring of the levers will do much towards throwing the slide forward, and with the aid of a spring, or a weight operating over a pulley, the wheel will be relieved for a retrograde motion.

When the engine is changed to the opposite end of the train, the levers of the brakes must be changed from *f* to *e*, which can best be done by a slide (not shown in this figure,) to which all the brakes must be attached by pins similar to those shown in fig. 2 ; which slide must move the necessary distance (6 inches), carrying with it the brakes to position *e*, and there bolted.

Fig. 6 represents the slides coupled—the bolts passing in horizontally—and the groove, &c. shaped so as to allow the cars to turn a curve without any pinching or strain.

The inventor, in answer to the question as to the cost of this brake, replies, "that it will be evident, from an inspection of the drawings, that there is nothing new in the brake itself, but merely in the application of the power. The brakes usually used are shown in the drawings, and in place of being attached to a rod and fastened to a hand lever, they are to be attached to a slide, to be operated by collision produced by the acquired velocity or impetus of the cars. The cost of this extra fixture certainly must be very *inconsiderable*—it is true that the adjusting slide must be added, which may be simply a bar of iron (or it may be of wood) extending the whole length of the car, and coupled to other slides, in which the pins are fastened when the tight coupling is used—or when the loose coupling is used, the adjusting slide may not extend the whole length of the main slide, being only long enough to couple all the brakes—and this slide may be very light.

[There is much ingenuity in the foregoing application of brakes. It is well known that in most accidents upon Railroads, no time is given to regulate the brakes, and in the instance of a very serious accident on the Camden and Amboy Railroad the attention of the agent was diverted by a spark on some goods, and when he discovered that the axle was broken it was too late ; he had no time to regain his position at the brake. Objections to the early form of Mr. Smith's brake have been obviated by his "adjusting slide." The trifling cost certainly renders an experiment of easy execution. Any thing that promises to add to safety and comfort deserves attention.]

Fig. 5.

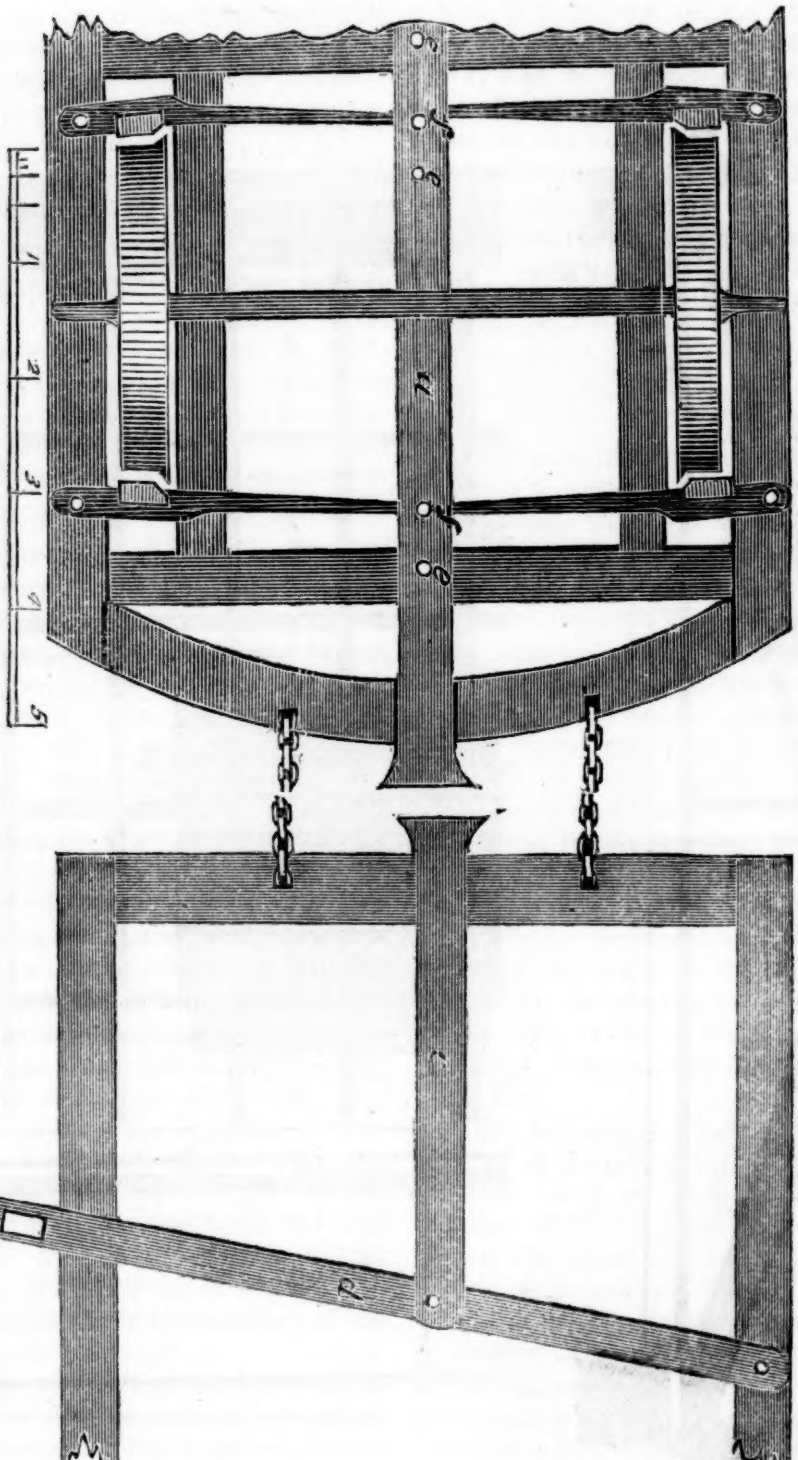
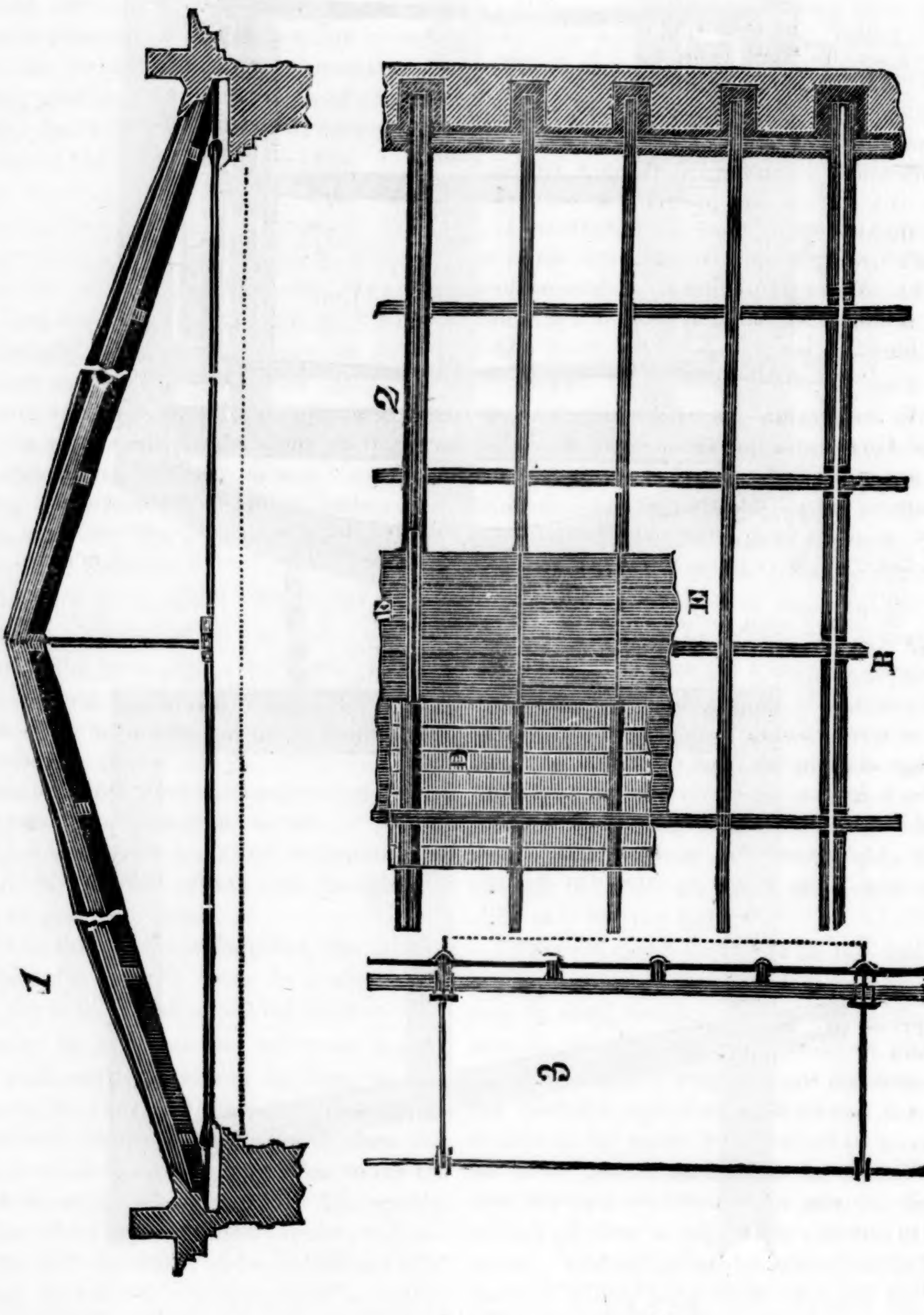


Fig. 6.


1
2
3

DESCRIPTION OF AN IRON-TRUSSED ROOF, CONSTUCTED OVER THE BORING-ROOM OF THE NEW GUN-FOUNDRY AT COSSIPORE, BY MAJOR G. HUTCHINSON, ENGINEERS, F. R. S., SUPERINTENDENT AND DIRECTOR OF THE FOUNDRY.

We extract the following description of this remarkable roof from the last volume of the *Journal of the Asiatic Society*, at the suggestion of an esteemed correspondent, to whom we feel much obliged for directing our attention to an article fraught with so much interest to our mechanical readers. Both the design of the roof, and the manner of carrying it into execution, do infinite credit to Major Hutchinson, in whom English science, and English mechanical skill, have found in India a most fit representative :—[London Mechanics' Magazine.]

"We have requested Major Hutchinson, of the Engineers, the architect of this elegant structure, to favor us with drawings of its various details, that we may make known as far as the circulation of our Journal permits, his very successful combination of the cast iron trust with a wrought iron tie to roofs of large span in this country. We are so little accustomed to see any thing else in India but the heavy flat roof with its massy timbers groaning under an inordinate load of terrace-work heaped up most disadvantageously in the centre to allow a slope for the water to run off, while the invisible white ant is scooping out the solidity of the timber, and the dry rot is corroding the ends that support the whole on the wall,—that the eye rests with quite a pleasurable sensation on the view of a light, airy framework like that before us, composed of materials indestructible, wherein the strains and pressures are counterpoised, the load lightened, the liability to crack and leak lessened, and the repair of every part rendered easy and entirely independent of the rest.

"The progress of improvement is notoriously slower in Government operations than in private works. When cast iron beams were first brought to India on private speculation, and were offered to Government by a mercantile house in this town, they were rejected. The roof of a large private godown was soon after constructed with them and their efficacy thus proved; then immediately a re-action took place, and a large quantity was indented for by Government. The Hon. Court sent them out, and they have remained until now totally unemployed, although numerous public buildings have been erected since they arrived.

"It was, we know, a subject of lengthened debate what sort of roof should be given to the foundry. A timber trussed roof had been sanctioned at 15,000 rupees, and we may, perhaps, rather attribute the substitution of the present one to the numerical reduction of the pecuniary estimate, than to any actual conviction of its superiority in other respects, for the beams being already provided, the whole cost of the present roof, exclusive of them, has been only rupees 11,000.

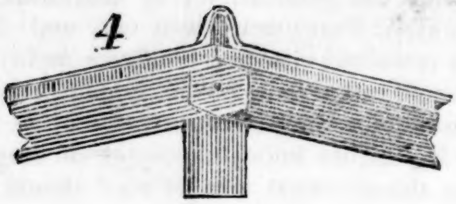
"The new foundry, or rather the room in which the cannon are turned and bored, is a spacious hall, of 169¼ feet long by 50 feet clear span in breadth, and 40 feet in height from the floor to the vertex of the roof; entirely open from end to end, lighted by a range of upper windows, and surrounded by a suite of apartments of half elevation. The steam machinery of the several borers and lathes is arranged along one side of this room, in a compact and exceedingly neat manner. It is impossible to attempt its description; those who are fond of mechanical inventions, will be amply gratified by an inspection of the whole, especially by the ingenious contrivance for adjusting the angle of the slide rests and cutters, for the exterior bevil of the gun:—the circular revolving tools for turning the trunnions;—the crane carriage for the guns, &c.

"The self-acting principle by which the exterior of the gun is turned, while the interior is bored, so as to save one-half of the time, while it insures perfect concentricity of the outer and inner circles, is, we believe, an invention of Major Hutchinson's, who took the opportunity when on furlough, of visiting some of the principal foundries in Europe, and studied to adopt every improvement suggested by their inspection.

"The whole apparatus is driven by two small engines of 10 horse power, which also work a circular, and reciprocating, saw, and a loam-mill for the casting moulds of the foundry, &c.

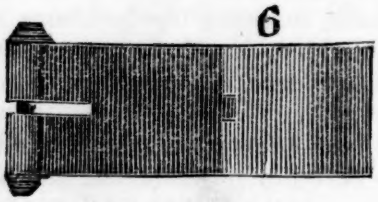
"The superficial area of the hall is 8,462 square feet; to form an idea of this magnitude, it may be mentioned that the

4



5

6



noble edifice of the new town hall in Birmingham, is said to contain a larger space than any room in Europe, and will accommodate between three and four thousand persons sitting or ten thousand standing; that room is 140 feet long, by 65 feet broad, making a superficial area of 9,100 feet, which is only 638 feet more than the Kasipur apartment.

"The roof consists of 10 trusses, each composed of a pair of cast iron beams pitched at an elevation of 6 feet in the vertex, and tied together at foot by a horizontal chain supported in the centre by a vertical rod suspended from the angle. The truss-frames are 15 feet 4·6 inches apart: they support light cross-beams and rafters of wood, upon which the planking of the roof is nailed. The weight of one truss with its entire load and chain is equal to about five and half tons, diffused over the two iron beams.

"The chain is 3 inches deep by 1 inch thick, = 3 inches in section, consequently the applicable force of tension of the chain is $3 \times 9 = 27$ tons, and the ultimate strength of it $3 \times 27 = 81$ tons. The above weight of five and half tons diffused over the two beams$=2\frac{3}{4}$ tons on each beam, gives, according to the sine of the angle of elevation, a tension on the chains of about five and a half tons, or only one-fifth the stretching weight, or one-fifteenth of the ultimate strength of the chains.

"The iron beams and chains were all proved before they were put up, by suspending for several days without effecting the slightest apparent alteration, a weight of six tons from the vertex, producing a trial tension of about 12 tons, which is more than twice the actual tension.

"Each extremity of the tie-rods is bolted to a kind of shoe, resting upon a stone slab on the wall, into which the lower end on the iron beam abuts.

"The longitudinal tie-rods are united by a bolt, having two right-hand screws, passing through the central coupling plates of the chains, and the eye of the suspension vertex rod. This rod being firmly attached by two bolts through the beams at the vertex, any derangement whatever of the roof, either vertically or horizontally, is effectually prevented. At each end of the roof the longitudinal rods pass through the walls, to which they are firmly fixed.

"The horizontal overlaps of the copper sheathing are cemented with white lead, and the copper passes over the wooden battens fixed on the planks, to which only the copper is fastened by copper rivets; a copper cap or ridge-tile lies over the whole length, to prevent the insinuation of water at the fold; it answers this purpose so effectually, that the roof was every where found perfectly water-tight, during the late heavy season of rain, the first it had experienced.

"The Kasipur roof was set up without the assistance of any scaffolding from below. An experimental truss of timber supported on chains, having been previously made to show the advantageous application of iron chains instead of tie-beams of timber to rods of so large a span, it was converted into a platform, moveable upon wheels along the top of the walls, upon which, by means of a crane fixed at one end of the frame, the iron beams and every thing else was easily and expeditiously raised and fixed; the beams, &c. for the opposite side of the roof being passed upon wheels across the platform. The whole frame-work was put up in twenty days.

"Before closing our short account of the Kasipur roof, we must notice a curious optical deception, for which we are somewhat at a loss for a correct explanation. On entering the room and looking up at the roof, it strikes every beholder that the roof has somewhat sunk, and the horizontal tie-rod is about five or six inches lower in the cen-

tre than near the walls. So firmly impressed were we of this being the case, that standing at one end of the room, and holding two flat brass rulers, overlapping one another, before the eye, we could readily measure the apparent angle of the tie-rod, by raising the ends of the rulers so as to coincide with the two halves of tie-rods. On mounting the roof and looking in at the upper window of either end, the same effect was still visible, though in a diminished degree, and we were not convinced that it was a deception, until Major Hutchinson, at our request, caused an actual measurement to be made by a perpendicular wooden batten, from an accurately adjusted level on the stone floor. It was then proved that there did not exist a difference of level even to the amount of a tenth of an inch. Whence arises the illusion? Is it that the eye, judging of directions by comparison with other objects, and having the numerous lines of the pent roof inclined in opposite directions to each half of the horizontal rods, is thus perplexed in its estimate; the ruler experiment is opposed to such an explanation. It may, perhaps, be owing to the effect of light from the upper windows, which frequently gives a curved appearance to wooden beams from the decrease of illumination from side to centre. If the phenomenon resemble the effect of the eyes in a portrait always looking the same whencesoever viewed, or the curves formed by spokes of a wheel passing a railing, as has been suggested, the effect should admit of a rigid explanation, and we may hope to obtain it from some one of our readers who may have time to investigate this singular deception."

Description of the Engravings.

Fig. 1, is a section of the roof. Fig. 2, a plan. Fig. 3, a longitudinal section through the vertex A B of fig. 2. Fig. 4, a transverse section through B C of fig. 2. Figs. 5 and 6, section and plan of the iron shoe. D, in fig. 2, is the copper sheathing; and E E, the planks.

TYRONE POWER'S IMPRESSIONS OF AMERICA.—RAILROADS.

From this amusing work of a clever ("English and Yankee clever") author, we have extracted the following remarks on the subject of our internal improvement. The writer commences with his opinion of an article in an English review quizzing the Yankees for attempting a railroad.

"I never in my life perused any article more philosophical in spirit or more conclusive in argument; the scheme was clearly shown not only to be absurd but impracticable, and the projectors proved either to be presumptuous imitators, or men profligately speculating upon the ignorant credulity of their fellow-citizens.

"I closed the review, in short, admiring the clear judgment and practical far-sigthedness of the writer; pitying the Yankees, for whom I cherished a sneaking kindness, and inwardly hoping that this very clever exposition of the folly of their seeking to counteract the manifest designs of Providence, which had so clearly demonstrated their paths, might produce as full conviction on their minds as it had on mine.

"Well, I forgot the article and its subject, and was only reminded of it by finding myself one fine day whisking along at the rate of twenty miles an hour, over a well-constructed railway, one of a cargo of four hundred souls. The impossibility had, in fact, been achieved; and, in addition to the natural roads offered by Sea, Lake, and River, I now found railways twining and locomotives hissing like serpents over the whole continent from Maine to Mississippi. Binding the cold North to the ever-flowing streams of Georgia and Alabama, literally with bonds of iron, and forming, indeed, the natural roads of a country, whose soil and climate would set at nought all the ingenuity of M'Adam, backed by the wealth of Crœsus and the flint of Derbyshire to boot.

"Now, had such a result been prognosticated only a few years back, the man whose foresight had led to such a large view of the subject would have been mouthed at as mad all over the American continent, and written down knave or ass, or both, in every practical journal of Europe.

"Such great changes constantly agitated, and reduced to practice with a promptitude of which even England, with her wealth, industry, and enterprise, has little notion, make discrepancies between the facts and opinions of rapidly-succeeding travellers, for which neither the veracity nor the judg-

ment of the parties can fairly be impugned.

"Action here leaves speculation lagging far behind; the improvement once conceived is in operation by such time as the opposing theorist has satisfactorily demonstrated its impracticability; and the dream of to-day is the reality of to-morrow.

"I feel, in fact, a difficulty in describing without seeming hyperbole, the impressions I daily received, and beheld confirmed by facts, of the extraordinary spirit of movement that appears to impel men and things in this country; this great hive wherein there be no drones; this field in which every man finds place for his plough, and where each hand seems actually employed either 'to hold or drive.'

"For ever wandering about as I was, and visiting, as I frequently did, the same places at intervals again and again, I had occasion to be much struck with a state of things of which I was thus afforded constant evidence; take for instance:

"My first journey in Sept. 1833, between New-York and Philadelphia, was by steam-boat and railway, having cars drawn by horses over thirty-five miles, which thus occupied five and a half hours. In October of the same year I did the same distance by locomotive in two hours. When first I visited Boston, the journey was performed in twenty-four hours, by steamer to Providence, thence to Boston by stage; the same distance now occupies fifteen hours, a railway having been last spring put in operation between Providence and Boston.

"Again, in 1834, the traveller had but one rough route from Philadelphia to Pittsburg. You can now go a third of the distance by railroad, and, getting into a canal-boat, are dragged over the Alleghany mountains, through a series of locks not to be surpassed for strength or ingenuity of contrivance.

"In 1833, the journey from Augusta, Georgia, to New-York, was an affair of eleven or twelve days; it is now performed in three. Steam and railroad, are in fact, annihilating time and space in this country. In proof of it, I can safely assert that if a traveller visiting the South-West, say from Savannah to New-Orleans, will be at the trouble of recollecting this book in the year 1837, he will find the account of the difficulties of my journey extremely amusing; since, in all human probability, he will perform that in five days, which took me, with hard labor, perseverance, discomfort, not to say some peril of life or limb, just eighteen.

"It is these revolutions, and such as these, that form the true wonders of this country; that stimulate curiosity, excite interest, and well repay the labor of any voyager imbued with a grain of intelligence or observation, to say nothing of philosophy.

"It is to these results, their causes, and their immediate and probable effects, his mind's eye will be irresistibly drawn, not to spitting-boxes, tobacco, two-pronged forks, or other *bagatelle*, the particulars of each of which, as a solecism in polite manners, can be corrected and canvassed by any waiter from the London Tavern, Ludgate-street, and by every *grisette* from American Square to Brompton Terrace, who may choose to display their acquired gentility 'for the nonce.'

"It is the absence of a spirit of philosophy generally in our writers, and this affectation of prating so like waiting-gentlewomen, that stings Americans, and with some show of reason, when they see the great labors of their young country and the efforts of its people passed lightly by, and trifles caught up and commented upon, whose importance they cannot comprehend, and the which they have neither leisure nor example to alter or attend to."

URE'S PHILOSOPHY OF MANUFACTURES.—The following is the preface to a late interesting work by Dr. ANDREW URE, upon the manufacturing operations of Great Britain.

We give the preface, with a view of calling attention to the work, from which we shall make copious extracts hereafter.

The present is distinguished from every preceding age by an universal ardor of enterprise in arts and manufactures. Nations convinced at length that war is always a losing game, have converted their swords and muskets into factory implements, and now contend with each other in the bloodless but still formidable strife of trade. They no longer send troops to fight on distant fields, but fabrics to drive before them those of their old adversaries in arms, and to take possession of a foreign mart.

To impair the resources of a rival at home, by underselling his wares abroad, is the new belligerent system, in pursuance of which every nerve and sinew of the people are put upon the strain.

Great Britain may certainly continue to uphold her envied supremacy, sustained by her coal, iron, capital, and skill, if, acting on the Baconian axiom, "knowledge is power," she shall diligently promote moral and professional culture among all ranks of her productive population. Were the principles of the manufactures exactly analyzed, and expounded in a simple manner, they would diffuse a steady light to conduct the masters, managers, and operatives, in the straight paths of improvement, and prevent them from pursuing such dangerous phantoms as flit along in the monthly patent-lists. Each department of our useful arts stands in need of a guide-book to facilitate its study, to indicate its imperfections, and to suggest the most probable means of correcting them. It is known that the manufactures of France have derived great advantage from the illustrated system of instruction published under the auspices of its government and patriotic societies.

The present volume, introductory to a series of works in more ample detail, is submitted to the public as a specimen of the manner in which the author conceives technological subjects should be discussed. Having been employed in a public seminary for a quarter of a century, in expounding to practical men, as well as to youth, the applications of mechanical and chemical science to the arts, he felt it his duty, on being solicited from time to time by his pupils, now spread over the kingdom as proprietors and managers of factories, to prepare for publication a systematic account of their principles and processes. With this view he resolved to make afresh such a survey of some of the great manufacturing establishments, to which he had liberal access, as might qualify him to discharge the task in a creditable manner. This tour of verification would have been executed at a much earlier date, so as to have enabled him, ere now, to have redeemed his pledges both publicly and privately given, but for an interruption of unexpected magnitude.

The Right Honorable the Lords of the Committee of the Privy Council for Trade and Plantations requested him, about three years ago, to undertake a series of experiments on the refining of sugar, in order to ascertain the relation of the drawbacks on exportation of refined loaves to the duties paid upon the raw article. Under an impression that these researches might be set sufficiently in train, in the space of two or three months, to lead to the desired information in the hands of experienced operatives, he undertook their arrangement; but encountered so many difficulties from the delicacy of the material operated upon, and other circumstances stated in his official report printed by order of the House of Commons, that he did not get entirely extricated from them till nearly two years were expired, nor till he had suffered considerably from anxiety of mind and bodily fatigue. Being advised by his medical friends to try the effects of travelling, with light intellectual exercise, he left London in the latter end of last summer, and spent several months in wandering through the factory districts of Lancashire, Cheshire, Derbyshire, &c., with the happiest results to his health; having everywhere experienced the utmost kindness and liberality from the mill-proprietors. Neither they nor the great mechanical engineers who construct their buildings and machinery, use any mystery or reserve towards a visitor actuated by legitimate feelings and principles; but, on the contrary, most readily show and explain the curiously-productive inventions which surround them.

The few individuals who betray jealousy of intelligent inspection are usually vain persons, who, having purloined a few hints from ingenious neighbors, work upon them in secret, shut out every stranger from their mill, get consequently insulated and excluded in return, and thus, receiving no external illumination, become progressively adumbrated; till, after a few years of exclusive operation, they find themselves undersold in the market, and deprived of their oldest or best customers by the inferiority of their goods. Were it not invidious, the author could point out several examples of clever people having thus outmanœuvred themselves, in trying to steal a march upon their friends in the dark. Mystifiers of this stamp are guilty of the the silly blunder of estimating their own intrinsic resources above those of all the world beside. It is, however, not more for the advantage

of the kingdom, than for that of every individual manufacturer in it, to receive light from all quarters, and to cause it by reflection to irradiate the sphere around him.

In tracing the progression of the British system of industry, according to which every process peculiarly nice, and therefore liable to injury from the ignorance and waywardness of workmen, is withdrawn from handicraft control, and placed under the guidance of self-acting machinery, the author has made it his business to study the descriptions of most of the patents of that nature obtained in Great Britain, France, and America, during the last twenty years,—a task in which he has been assisted by Messrs. Newton and Berry, of Chancery-lane, gentlemen deservedly esteemed for the soundness of the specifications which they professionally prepare for patentees.

To James Cook, Esq., of Mincing-lane, he is indebted for the extensive assortment of samples of raw cotton, wool, flax, and lilk, which have formed the principal subjects of his microscopic researches upon textile fibres, as also for much valuable information on the statistics of trade.

Nor ought he to leave unacknowledged the polite readiness of S. M. Phillipps, Esq , Under Secretary of State, and of Mr. Porter, of the Board of Trade, to aid his formation of a census of the factory population, and his inquiries into the commerce of the kingdom.

In delivering this general Treatise on Manufacturing Industry into the hands of the public, the author is not unconscious of defects, both in its matter and arrangement; for most of which, however, an apology may be found, in the vague and contradictory opinions entertained by experienced manufacturers on many departments of their business. Those of his readers who have most deeply considered the difficulties of his undertaking will not be the least indulgent.

The body of facts distributed throughout the volume have been most carefully verified, and will, it is presumed, bear the strictest scrutiny, though a desire to keep the volume at such a price as would bring its purchase within the reach of working-men has precluded the multiplication of notes of reference to authorities. The main portion of these, indeed, would have been to the reports of Parliamentary Committees; many great folios of which have been diligently consulted in quest of authentic information—though sometimes to little purpose. In consequence of the judgments of even honest men being strangely perverted by passion, prejudice, and self-interest.

The engravings at pages 48, 49, 120, 162, 271, 273, afford specimens of the original drawings of machines made under the author's eye, for illustrating modern manufactures; the complete series of which, when published in his forthcoming works on the cotton trade, dyeing, calico-printing, &c., will, it is hoped, constitute an interesting gallery of practical science.

London, June 18th, 1835.

From the Annals of Education for April.

FUNDAMENTAL PRINCIPLES OF THE PRUSSIAN SCHOOL SYSTEM.

We have recently conversed with several officers of the Prussian government in reference to their system of education.—To enter fully into this system and to understand completely any portion of it, it must be remembered that in this kingdom, the State, the Church, and the School, are inseparably united by numerous and intimate bonds. The government is at the head of the church and the school—if we may be allowed to use the latter term in the same general sense as the other, to include all the schools of the kingdom. It assumes the right to prescribe that every village must have its church and its school, that every man shall have the means of religious instruction—that every child shall attend some school. It does this on the ground that its citizens should be prepared to become good subjects, and that they cannot be so without receiving both intellectual and religious instruction. Its right is undisputed to preserve the bodies of its subjects from injury, and to have them trained to military exercises, and military skill, that they may be prepared to serve and defend their country by physical power, and prevented from becoming burdens for want of it. It claims the same right to guard their minds from debasement and corruption—to require, that they should receive that instruction which will aid them in gaining a subsistence, and being useful to their country; and that moral training, which will make them good subjects.

It does not seem to enter into the conception of any officer of State, or church, or school here, that order can be secured in a community without religion, or that morality can have any other sold basis than *Christian instruction and Christian training, in a Christian spirit.* In reference to mere secular instruction, the state prescribes the subjects and directs the modes of teaching through a number of instructors, and a body of inspectors appointed for this purpose, and appointed simply for their qualifications in this respect without any of those distracting questions and jealousies about party or sect which would embarrass our governments. But in regard to religion, it assumes only the right to decide, and to insist, that *instruction shall be given;* leaving to the clergy of each church the entire direction of the subjects and the manner of instruction.

The laws, however, decide one point absolutely, that religious instruction must take the first place in importance, and from a part of the business of this school daily, for not less than one hour in six. It will not permit that it should be confined to the weekly catechetical instruction of the clergy, which is given with a regularity and minuteness unknown to our clergy in general, and still less to the irregular and uncertain instruction of parents, so many of whom cannot if they will, or will not if they can, attend properly to this part of their children's education.

In the application of these principles the laws appear to secure every important point. Provision is first made for the preparation of Christian school masters, of the leading denomination, by the establishment of distinct seminaries for teachers, sustained by government, but regulated and inspected by the clergy of the respective churches. Where the parents in a school district are agreed in reilgious opinions, a teacher of the same sect gives religious instruction, under the direction of the pastor, and everything goes on with regularity and in harmony.

In places where each of two or more denominations is sufficiently numerous to *sustain* a school, the Government, although connected of itself with the reformed, or as it is now termed the evangelical church, consisting of the old Lutherans and Reformed united, establishes and sustains schools for each. The Catholic Seminaries supply teachers for the Catholic schools, and even the Jewish children are furnished with an instructor of their own sect.

The most perplexing case is that in which the inhabitants of a small village or district are so divided that no single sect is sufficiently numerous to sustain a school. Here the laws direct that a "simultaneous school" shall be established; that is,—one in which children of *all sects* are united for the purpose of mere intellectual instruction. Still, the Government here insists, that religious instruction shall be given in connection with the school. Pastors are accordingly required to give instruction to the children of their respective flocks, during the week, and are subject to the supervision of the Inspector of Schools, in regard to the faithful performance of this duty; whilst no interference is allowed as to the opinions taught. There is so little jealousy between *good* men, even of different denominations, that the teacher of such schools is sometimes of one sect, sometimes of another.

It is in this manner that the Prussian system of education establishes certain fixed points of support, which leave room for universal and indefinite improvement, and which brings every institution of society in harmony with the rest. It secures permanent superintendents devoted to these objects, previously well-qualified, and gaining every year stores of experience for themselves, and the minister of education, by their regular tones of inspection and examination, and aided by the more detailed reports of local inspectors. It is in this manner they furnish every child in the land with a complete and harmonious course of instruction of the best kind, and *confer no power* on a subject, without endeavoring to instil the principles and form the habits of thinking and feeling which shall direct him in *using it aright.*

The nature of the Government also enables them to execute a law,—which however reasonable, might meet with resistance elsewhere,—to secure by civil regulation the attendance of every child on the instruction thus provided.

It would seem at first sight difficult to apply such a system to countries differently situated. It is certain indeed, that where the direction rests with the mass of the people, light must be more extensively diffused, and education better understood, and

more highly appreciated, before such measures can be executed, or even adopted. It is not less true, however, that if we admit the fundamental principles, that the State has as much right to claim the mental, as the bodily services of its citizens, and to require suitable preparations for it, and that religious instruction is indispensable, as the basis of moral principle, and of a spirit of obedience to the laws, and of genuine liberty, the plans adopted to carry them into effect, are the most simple and excellent which could be devised.

Frankfort on Mayne, Nov. 27, 1835.

AVERY'S ROTARY ENGINE.

This engine has become a subject of considerable interest, not only in this country but in Europe. We have been frequently inquired of by letter and otherwise, as to its ability, cost, cost of fuel and attendance, &c. &c.—yet, although entirely satisfied as to its ability and economy, until the present time we have been unable to give a definite answer to these questions. And, indeed, even now, we do not speak with that *precision* in relation to *cost* which we should like, although we are sure to put it high enough; and even a little *beyond* the mark, that those who purchase may, if at all, be favorably disappointed.

After repeating the remark of a gentleman of much experience with steam engines, viz. "that when it was in successful operation, if they would give him a good pair of *leather mittens he would hold* it"—meaning that he could take hold of the shaft on which the *arm* is fixed, and with which it revolves at the rate of 3000 times a minute, and stop its motion if he had on a pair of "*leather mittens*"—we will proceed to give some particulars in relation to it, which, from personal observation, and from the statement of the intelligent superintendent, we can vouch for.

The arms of the engine are 30 inches long from the exterior of the shaft to the apertures, and the apertures are each the $\frac{1}{10}$ of a square inch—they are inclosed in a circular cast iron case—the shaft receiving the steam at one end and having a pulley for the main band on the other.

The following machines are all attached to, and operated by it, viz:

1 upright saw with 30 inch stroke, or 15 inch crank—averaging 110 strokes per minute.

1 buzz saw, 24 inch, cutting a kerf of $\frac{3}{16}$ of an inch, with 22 to 2400 revolutions per minute.

3 24 inch circular veneering saws.

1 26 " " " "

1 27 " " " " varying from 12 to 1500 revolutions per minute.

1 15 inch buz saw, with 1200 revolutions per minute, and

1 whip saw for curves, with 9 inch sweep and 250 strokes per minute.

1 grindstone.

1 blower for the furnace.

And the pump raising water 30 feet into a resorvoir for its own use.

These machines are not *always all* at work at the same time—as some of them require repairing, or filing, or they are taking off or putting on logs, but this may be said without fear of contradiction—they *can* all be driven at the same time by the engine now in use, for 10, 12, or any number of hours that the superintendent and hands can tend it—and that, too, with the evaporation of an average *not to exceed* 40 *gallons of water per hour.*

The boiler now in use was made for a piston engine, and was intended for 15 horse power.

It has been asked, and frequently, what is the power of this engine. This is a question easier asked by many, than answered—yet most practical men form an opinion for themselves, of the power required to carry this machinery—and it is, of course, in this way, estimated variously

It cannot, however, we presume, be pu down at less than the following estimate viz:

	Horse Power.	
The upright saw, sawing 110 feet per hour,	5	5
" large buz saw, sawing 120 feet per hour,	5	5
" small " "	1½	1½

The veneering saws,	1 each	5
" whip saw, grindstone, pump, and blower		$1\frac{1}{2}$
		18

But to avoid over-estimates, we will put the whole at 15 horse power, to accomplish which 40 gallons of water are evaporated at an expense of fuel of *one dollar* for every ten working hours, and $1,25 cents for attendance on the engine and fire.

It should be borne in mind, that these saws are all used in sawing mahogany—except the whip-saw, which is used for sawing all kinds of timber.

In addition to the above, a turning-lathe is to be put in operation in a few days.

The question has been and may be again asked, what will the boiler and other fixtures cost, to put this engine in operation?

It may be answered, although not very satisfactorily, by saying that the boiler and fixtures for driving it will not cost more than for any other engine of equal power. On this point, we hope soon to be able to speak more definitely.

We desire to call the attention of our readers to an article from the Journal of the Franklin Institute, in relation to this engine, published in No. 13 of this Journal—and also to one in the same number, signed "Hiero," as they will, we believe, with this statement of facts, tend at least to shake, if not to dispel, some of the prejudice against, or disbelief in the power and utility of, this engine. If more particular information is desired, it may be obtained by addressing, post paid, William Avery, or E. Lynds & Son, Syracuse, New-York, or Mr. Joseph Curtis, the agent for this city, or the Editor of this Journal.

By the way of comparing it with other engines, we shall feel greatly obliged to any gentleman who will give us a statement of the *water and fuel used*, and labor performed, by a *piston engine of fifteen horse power!* When received, we will lay it before our readers.—[Ed. R. R. Jour.]

Professor Barlow's Report on Railways.—In the London Mechanics' Magazine for February, which has just come to hand, we find some extracts from the Report of Professor Barlow, who was appointed by the Directors of the London and Birmingham Railway Company to visit the Liverpool and Manchester Road for the purpose of ascertaining the best form of rail, chair, &c. &c.

The report, judging from the extracts, promises much useful information on the subject, and we shall endeavor to obtain it and publish it entire.

Since the publication of his first report (of which we gave a full abstract in No. 612), Mr. Barlow has been again engaged by the Directors of the London and Birmingham Railway, "to visit the Liverpool and Manchester Railway, to view that line, and advise this Board as to the weight of rails, the description of chairs and fastenings, the distance of the supports, and the size of the blocks that he would advise the Directors to adopt; and to accompany such advice with any observations generally on the subject."

Accordingly, accompanied by two of the London Directors, and met at Liverpool by two of that town, he entered on his task, furnished by the liberality of the Liverpool and Manchester Railway Company with every necessary facility and accommodation.

The following extract, besides showing the necessity of the investigation, presents a vivid and faithful picture of the uncertainties and contradictions into which practical men fall when they despise the help of theorists, while it gives, and on proper grounds, the weight unquestionably due to the opinions formed by these same practical men from constant observation:

"We met as appointed, at the Liverpool station of the Liverpool and Manchester line, and employed the first day in examining the state of the rails, chairs, and blocks, modes of fixing, and other particulars. In the course of this examination, I took the opportunity of inquiring on the spot the opinion of the resident engineers, contractors for repairs, workmen, and others, relative to these several points; but I was much disappointed to find those opinions, in most instances, discordant, and in many directly contradictory; a circumstance the

more remarkable, as one would have thought that five years' incessant practice would have been sufficient to eradicate many early erroneous ideas.

"I am not myself a practical man, but from my situation and pursuits I have been for nearly thirty years in almost constant intercourse with two of the largest and most varied mechanical establishments in the kingdom, and have, during that time, witnessed or superintended a vast number of experiments and trials on various mechanical subjects, many of which I have afterwards been enabled to examine in the works at large; I am therefore, to a certain extent, acquainted with what theory gives, and what practice requires, and the limits it prescribes; so I am also with the views and arguments of practical men, who I know sometimes, like other persons, in their anxiety to avoid one evil lose sight of other collateral evils, which their remedy increases or creates; but I must say that I never saw this so strongly marked as on the present occasion, nor such a diversity of conflicting opinions on what appears so simple and plain a case. This is a circumstance much ro be regretted, not only as regards the doubts which it naturally throws upon the mind of proprietors, embarking large amounts of capital in the undertaking, but also in respect to practical men themselves, whose judgment must suffer depreciation by such discordance. Opinions derived from long experience are exceedingly valuable, and outweigh all others, while they are consistent with facts and with each other; but they are worse than useless when they lead, as in this instance, to directly opposite conclusions.

"In making these remarks, I beg to be understood as intending no disrespect to the opinions of practical men generally, but simply to show that it was impossible, in this case, for me to be guided by them, and thereby to justify the plan I soon determined to adopt; viz. to avoid, as far as possible, argument founded on mere hypothesis, and to substitute for the latter, facts drawn from actual experiments, which should be made publicly, registered generally, and witnessed by any one interested in the decision; and moreover, as I intended to rest my report entirely on these data, I resolved to offer no opinion, till I had time to analyze and compare my results. I am not certain that this plan of proceeding was quite what the deputation most approved, but I feel convinced that it was the only way in which justice could be done to the inquiry, and confidence obtained for the decision."

The dimensions of a railway-bar to support any given *quiescent* load had become pretty well known, but practical men doubted and differed as to what was required by an engine and train *in motion*, whether more or less, and how much. Knowing that the results of theory, when opposed to their previous opinions, obtain little confidence from practical men, and would, therefore, be slighted by part at least of those for whose guidance the inquiry was undertaken, the Professor wisely resolved to found his Report on experiments alone; and these are happily such as may be repeated at any time, and at small expense, till the results from them are established beyond dispute. A horizontal lever, of which the arms were as 10 to 1, was mounted between centres on a plank; its short end was placed in contact with the under side of the rail, and the other showed the deflection ten times magnified. The effects produced by the passing engines and trains were minutely observed with this *deflectometer*; and several instruments were provided, and used at once, so as to show conveniently the effects produced on different parts of the bar and its supports, by the passing of the same load. Though some objections might be made to the manner in which it was used, and, consequently, to the arguments for rendering its indications comparable with those of former experiments, it is certain that it has already furnished important data, and that it will become one of the most indispensable instruments to the railway engineer. Its first trial produced the following lesson for railway managers, which surely will not be lost upon them:—

"Our first experiments were only tentative, with a view to try the instrument, but even in these much was very distinctly shown; when, for example, a train passed over, we could see clearly the operation of each wheel upon the rail, which, where these were well laid, and the joints and blocks secure, were only of a certain amount; but when the rails were unlevel, or other irregularities occurred, some lurch would take place, towards the middle or end of the train, which would strike the rail with sufficient force to throw up the index to nearly

double its previous amount, indicating, of course, that it had, in the case in question, sustained a deflection nearly double what it would have done with the same weight in a quiescent state."

Numerous and varied experiments with this instrument, while they indicate a small increase of deflection with increase of velocity, seem also to have ascertained that it is too small to need much addition to the strength of the rails; for on comparing these observations with those made at Woolwich with quiescent weights, it may be doubted whether, when allowance is made for the manner in which the deflectometer was used, any real excess of deflection was occasioned by the passing load. This, however, was not the case with the joint lengths, where the deflection was 40 per cent. additional; it is not suggested how this is to be prevented, but it is attributed partly to the looseness of the chair and block.

It seemed desirable to know, whether the deflection produced by *lateral* pressure on the outward rail in curves, required an addition to the strength of the rail in that direction; for this purpose a deflectometer was constructed of a somewhat different shape. The result, however, was, that rails sufficient for their work in other respects, would not fail under this strain, so that the subject needed no further attention.

The deflectometer rendered very apparent the importance of placing the blocks in every case opposite to each other. Until this and other precautions are taken, the constructors of railways must be content to use rails very much heavier than the work of the road actually requires:—

"In consequence of the imperfection of these parts (the blocks, &c.), a strain is occasionally thrown on the rail which produces a deflection about double that which belongs to the load in question. This effect was frequently and obviously exhibited in the experiments with the trains. In many cases, the deflectometer showed only the common amount of deflection when the engine (by far the heaviest load) passed over; whereas, perhaps in the middle, or at the end of the train, a wagon would lurch over from some irregularities, and throw up the index to double its former amount. This effect was very particularly noticed by the deputation, Directors, Proprietors, and other parties present. It follows, therefore, that till greater perfection can be obtained in railways, a strength of bar more than double that due to the mean strain must be provided. In my former report, I have allowed 50 per cent. beyond the double, as a surplus; but from these experiments, it appears this allowance is in excess, and that from 10 to 20 per cent. beyond the double will be sufficient; that is, for a 12-ton engine, as the weight is at present distributed, a strength of 7 tons would be an ample provision, and with greater accuracy of construction, such as the care now taken may be expected to ensure, a less strength would be sufficient; or rather, allowing the same strength, an engine of 14 or 16 tons might be passed over with the greatest confidence.

"By referring to the observed results in the Appendix, it will be seen, that one rail is sometimes depressed by one wheel a quarter of an inch, while the other wheel is perhaps on a block; and immediately after the high wheel is depressed, and the lower wheel raised, giving thus a rocking motion to the carriages, the effect of which was rendered remarkably obvious by the little instrument employed. No doubt much of this is due to a want of parallelism in the bearing blocks; and therefore, as one step towards correction, I would recommend it to be made a special instruction, *that the blocks shall in every case be placed immediately opposite to each other*, which, in parallel rails, may always be effected without expense or inconvenience. Other corrections, however, are necessary, which will be noticed in their proper places."

Another branch of the subject is the length of bearing, and the consequent inquiries as to the sectional dimensions of the rail and stability of the blocks and chairs. Adopting the parallel rail, and rejecting the double-headed one, Professor Barlow determines from experience that the head of the rail ought not to have a less sectional area than $2\frac{1}{2}$ inches, that is, it should not weigh less than $22\frac{1}{2}$ lbs. per yard, and that the entire depth must not exceed 5 inches. Commencing with these assumptions, he gives plans, computations, and tables for rails with bearings of the lengths of 3 feet, 3 feet 9 inches, 4, 5, and 6 feet, the sections being so arrangedas to give the maximum strength.

In discussing the best sectional form of rail, Mr. Barlow makes an observation well worthy of remark:—

"In the sections given in a preceding page for rails at different lengths of bearings, it will be seen that I have confined the breadth of the lower web to $1\frac{1}{4}$, or, at most, to $1\frac{3}{5}$, inches. and this has been done, although I am well aware that, to extend the breadth of the lower web, and to reduce its depth, would theoretically give the strongest rail; in fact that the double T is, on paper, a stronger rail than the deep and less broad flanched rail, but I am quite convinced it is not so in practice. The lower web comes no other way into use than as it is brought into a state of tension by the action of the centre rib; and although the fibres of the lower web lying immediately below the centre rib are brought into action by it, and that these fibres excite a similar action laterally in those immediately contiguous to them, and these again to the next, and so on, yet in a ductile metal, like malleable iron, this lateral effect is soon lost; so that the extreme fibres of the extended lower flanch become inefficient.

"To convince Mr. Locke and some other gentlemen of the weakness of the double T form, I had one of the rails taken up, and $\frac{1}{2}$ an inch cut away on each side from the lower flanch, reducing its breadth at the point of greatest strain, that is, in the middle of the bar, to $1\frac{1}{2}$ instead of $2\frac{1}{2}$ inches. It was then put into the press, and the trains brought on as usual, under the superintendence of Mr. Edward Woods and Mr. John Gray; Mr. Locke himself being obliged to leave just at the time the experiment was in progress.

"Mr. Rathbone, Mr. Edward Cropper, and myself, were also present, and the result was, that the bar thus mutilated showed greater strength than the mean strength which Mr. Locke found to belong to it when whole. Now, although I am ready to grant that the bar was actually weakened, and that this apparent anomaly is attributable to the imperfection of the press, yet, on the other hand, it must be admitted that it could, with such a result, have lost but little of its strength, and that the iron thus abstracted, viz. nearly $\frac{1}{8}$ of the whole section, if judiciously introduced elsewhere, would undoubtedly give a much stronger rail."

While we fully admit the importance of these remarks, we imagine they will require further illustration before they obtain general assent. What is the longitudinal form assumed by the extreme lateral fibres supposed to be so nearly ineffectual? If it be the same as that of their neighbor fibres toward the centre, it has required force to extend them—if it be nearer a straight line, they have hindered to some amount the extension of their fellows. Mr. Barlow does not hazard opinions lightly, and will probably, on some future occasion, give further reasons for the conclusion at which he has arrived.

In testing the stability of the blocks, the deflectometer again did good service. Though no great exactness was attained, it appeared that blocks, five feet asunder, sunk as little under a passing load as those but three feet apart. Considerable difference of opinion seems to exist, as to the economy and propriety on other grounds, of the use of more or fewer blocks. The arguments on both sides are given; some of which seem to show that the Professor's help was by no means superfluous. He gives his own opinion in these words:—

"The conclusion to which I am brought, as to the relative expense of maintenance per block in five feet and three feet bearings, or, more generally, in long and short bearings, after well weighing all these points, is, first, that in embankments, and where there is a soft sub-soil, the expense would be greater at first with the long bearings than with the short, but that it would ultimately become the same, although certainly never less; and, secondly, that on rocky, or very solid bottoms, the expense would be very nearly the same from first to last."

It can scarcely be doubted, that, while the earthern surface on which the block rests is new, it will be a little compressed permanently by every blow, and the number of blows being as the distance between block and block, it will be sooner compressed under long than short bearings; but, as soon as it has become so hard as to return to its shape after the greatest blows to which it is liable, it is of little importance how often it is struck; that is, whether the bearings be long or short.

The form of chair he prefers is one which would admit a plain single T rail; but, as the rail he decidedly recommends has a bottom flanch, it is proposed, that, where the blocks fall, a protuberance shall be left on the middle rib, so as to fill up its thickness to a level with the perpendicular fore

of the bottom flanch. A rail is thus obtained which admits the use of a plain chair; but the adaptation of particular spots to the chair seems to bring on the same difficulty with respect to the placing of the blocks opposite to each other, as was found in the case of the fish-bellied rail. It seems possible to avoid it in either case by making the bearing places half an inch longer than the width of the chair. The reason given by some for preferring the fish-bellied rail, "that its weak neck allows it to follow a sinking chair," is certainly a curious specimen of engineering sagacity. The further observations on the best form of chair deserve careful attention.

The section on "the formation of the joints" opens very curiously:—

"On carefully examining the joints of the rails on the Liverpool and Manchester line, I am disposed to estimate that about one in six of the plain butt joints are as perfect as can well be desired, and that another one in six are as bad as bad workmanship and negligence can make them; the remaining two thirds varying in character between these two extremes."

Has this celebrated road produced its splendid effects, while one half of its power has been wasted, and its cost of repair doubled by bad "workmanship and negligence?" What may not be hoped for when searching inquiries like the present shall have brought up railway furniture even to the present standard of decent workmanship?

After urging the necessity and attainableness of much greater accuracy, and stating that government work is much better done, the report proceeds—

"In the smaller shells, which are still considerably larger than the opening in a railway chair, and unquestionably much more difficult to cast, not more than a deviation of $\frac{1}{30}$th of an inch is allowed, and I can see no reason why the railway chairs and the end of the rails, should not be submitted to at least as close a gauge. To enforce this accuracy, may perhaps incur some present charge, but do not the wear and tear of the rails and engines incur a much larger constant expense of maintenance? I am sure it is unnecessary for me to urge this point upon those proprietors who witnessed, during the experiments, the concussion on the rail exhibited by the deflectomer, which, of course, produced a light concussion on the engine and carriages. The whole of these were, doubtless, due to irregularities, of which the want of parallelism of the blocks and bad joints were the principal. Some persons present attributed them in part to flat places in the wheel; but if there are flat places in the circumference of the wheel, to what are these attributable but to bad joints? To be convinced of this we have only to consider what must be the effect of a blow on a wheel supporting a load of 3 tons, and moving with a velocity of 30 or 32 miles per hour, when such a body meets the end of a rail rising $\frac{1}{7}$, or, perhaps, nearly $\frac{1}{4}$ of an inch above another; or when the joints are so open as to allow the wheel to fall from one upon the other, with all the impetus due to such velocity.

"In order to arrive at some estimate of this effect, a bad or open joint was selected, the deflectometer applied to the block, and the shock measured by the instrument. The rail was then taken up and relaid, so as to make the joint as close as usual, leaving the opening at the other end, and the effect was again taken, when it was found that the bad joint increased the force of concussion full 50 per cent.; that is, the engine had to sustain a shock from this circumstance one-half at least greater than was due to a very common joint, and probably double what it would have had to sustain at a good one."

Thus we may add, that the same care which is required by the "scarcely-perceptible" but important curve in the bottom of Mr. Locke's chairs (p. 55) would certainly produce much better articles than those described as in use on the Liverpool and Manchester line.

The following is the summary which the Professor gives of his Report:

"1st. I am of opinion, that as far as is consistent with the amount of the first outlay, it is desirable to increase the weight or section of the rails, and to decrease proportionally the number of bearing blocks.

"2d. That in cuttings and other places furnishing a good firm bearing, the present size of blocks is sufficient; viz. allowing for the intermediate blocks four feet, and for joint blocks five feet, while the bearing length does not exceed five feet; but that on embankments they will probably require

to be proportionally increased in size. But I recommend this to be put to the test of actual experiment.

"3d. I am of opinion that the cost of maintenance will, in the former case, after a short time, be in proportion to the reduced number of blocks, but certainly not less.

"4th. I consider the double and equal flanched rail to be inferior, in strength and convenience of fixing, to that which is described and modified to suit different distances, in a preceding page.

"5th. I consider Mr. Sinclair's proposition for rendering the rail plane at its points of bearing, to be in every respect recommendable.

"6th. I am of opinion the form of chair, and method of fixing the rail in the chair, proposed by Mr. Stephenson, is as simple and efficient (adopting the plan of rolling of Mr. Sinclair) as can be desired.

"7th. Yielding, as I am always ready to do, to practical opinions, when they are found pretty generally to agree, I am disposed to think the present mode of fixing the chairs to the blocks, with a wooden plug and iron pin, is, from its simplicity and convenience, the most recommendable.

"Lastly. I am strongly convinced that no change or modification of form will produce any essential improvement, till greater uniformity be enforced in the figure and dimensions of the rails and chairs, and greater attention paid to the parallelism of the blocks, and to a proper adjustment of the distances of the ends of the rails from each other to allow foi expansion and contraction."

Some important theoretical investigations follow the Report, which we cannot notice at present, further than to extract two important conclusions.

It is found, "that the sum of all the variable resistances to a load by the deflection of the bar over which it passes, is exactly half the resistance the load would experience in ascending a plane of the same half length, and whose height is equal to the central deflection of the same bar."

From the table-page 88, it seems that the increase of power required by the deflections of the bars, is nearly proportionate to the distance of the blocks; a fact which is certainly to be taken into account when determining the length of bearing.

The appendix details many experiments not given in the body of the Report.

The whole forms a very valuable contribution to our knowledge on some of the most important subjects connected with the construction and management of railways. We cannot but hope, that the same profound mathematician and veteran experimentalist will be again engaged, in illustrating the theory and correcting the practice of this most influential of recent inventions.

RAILWAY TUNNELS.

(From Mr Gibb's Report upon the several proposed Lines for a Brighton Railway)

An objection has been made generally to all tunnels—namely, that the air contained in them will be so contaminated by the noxious gas produced by the locomotive engines in passing through them, as to render it unfit for respiration. Whether this objection has ever been advanced, or at all supported, by any scientific man possessing sufficient chemical knowledge to enable him to judge correctly on the subject, is doubtful. The probability, however, is, that the fear of any injurious effects from foul air has originated in those who have witnessed the effects produced by steam engines in passing through the small tunnels on some of our canals; and if they have for a moment imagined that any similarity will be found in the effects in the two cases, their fears are quite justifiable. The tunnels on canals are commonly constructed of such limited dimensions, that it would be highly dangerous to attempt the same application of steam power as will be necessary on a railway; for instance, in the tunnel constructed by Mr. Telford on the Hare Castle Canal, the area above the water in the canal is only about one hundred feet; and even the Thames and Medway in transverse dimensions, perhaps the largest canal tunnel in England, has only an area of four hundred and fifty feet; while the smallest tunnel contemplated on the Brighton Railway, will have an area of at least six hundred feet.

In order to explain to what extent the air in a tunnel is contaminated by a locomotive engine passing through it, let us suppose a tunnel one mile in length to be traversed by a locomotive engine, and its train of a gross weight of one hundred tons. The experience of the Liverpool and Manchester Railway has shown that the average

consumption of coke is considerably less than half a pound per ton for each mile it is carried on a railway; but taking the consumption at half a pound, the whole weight of one hundred tons will require the consumption of 50 lbs. of coke. It may be calculated that every 10 lbs. of coke will evaporate a cubic foot of water; so that the whole 50 lbs. will convert into steam 5 cubic feet of water in the distance of 1 mile. Now to convert into steam 1 cubic foot of water, requires 1,950, or say 2,000 cubic feet of air, then 5 feet of water will of course require 10,000 feet; and this will be the whole amount of contaminated air in one mile in length of tunnel. To determine the proportion of such an amount of foul air, and the whole air contained in the tunnel, we may take for example a moderate sized tunnel 30 feet high, and having an area of 800 feet. One mile in length of such a tunnel will contain 4,224,000 cubic feet; hence the contaminated air will bear to the whole quantity in the tunnel the ratio of 10,000 to 4,224,000; or it will be as 1 to 422. It will scarcely after this appear that any valid objection to tunnels, to assert that an injurious effect must result from the contaminated air, when we find that the quantity of this description of air, produced by the passing of the whole train, will be no more than $\frac{1}{422}$ part of the whole quantity in the tunnel.

Let us then venture to hope, that any prejudices which may now exist against the construction of tunnels upon railways will be dispelled, when we find that no injurious consequences will ever result from the foul air, or any other of the numerous evils which have been so forcibly dwelt upon by those who affect to perceive the most unhappy consequences from their adoption.—[London Mechanics' Magazine.]

DEPTH OF MINES.

	Feet.
Kits puhl copper mine in the Tyrol mountains, - - - -	2764
Sampson mine at Andreasberg, in the Hartz, - - - - -	2230
Valencia mine, (silver,) Guanaxuato, Mexico, - - - - -	2170
Pearce's shaft, (copper,) consolidated mines, Cornwall, - - -	1650
Monkwearmouth colliery, Durham,	1600
Wheal Abraham mine, Cornwall,	1410
Eiton mine, Staffordshire, -	1380

The deep mines in the Tyrol, Hartz and Andes, above described, are all in high situations—the bottom of the Mexican mine is six thousand feet higher than the top of the Cornwall shaft. The deepest perforation beneath the level of the sea, and consequently the nearest approach to the earth's centre, has been made at the Monkwearmouth colliery, which is fifteen hundred and thirteen feet below the surface of the German ocean. Pearce's shaft (thirteen hundred and thirty-eight feet below the level of the sea,) was, until lately, the deepest in the world.—[Geology in 1835, (Mining Review.)]

We have extracted the following notice of the manufacture of Beet Sugar, desiring to bring all the information on the subject before our readers.

We are under the impression that the *white beet*, or *scarcity*, contains more sugar and less coloring matter than the *red beet*, the *betterave* of France.

MANUFACTURE OF BEET-ROOT SUGAR.—We are indebted to Mr. Isnard for the following interesting communication, accompanied with a number of documents, which we regret that we have not room to notice at the present time, any farther than to say that they fully confirm the statements contained in the letter.

BOSTON, March 28, 1836.

To the Editor of the Daily Advertiser.

SIR,—If you should judge the present communication worthy of attention, it is at your disposal. In order to satisfy yourself concerning the authenticity of my statements I subjoin documents for your perusal, when at leisure.

The manufacture of Sugar of Beet has ceased to be an object of ridicule; the advantages that France draws from it are palpable and great, and the benefits which the manufacturers derive from it are now such that the French Minister of the Treasury has proposed to lay a tax upon it. France owes this new branch of industry to that great man whom she will honor through all time; for, had it not been for his sagacity and powerful assistance, it would have shared the fate of many other improvements lying for ages, or dying in their in-

fancy, once pronounced by ordinary men visionary projects.

The discovery that beet contains a perfect sugar remained for over sixty years without any useful application; many attempts, however, had been made to derive the benefit of it; but those having made these attempts, being rather men of science than men of business, having operated only upon a small scale, with purely scientific views, and having made no calculations, either of expenditures or results, they had no ground to proceed upon. I undertook to solve that problem, and to that effect made, the first in France, an experiment on a large scale, and by a sufficient reward induced a chemist to assist me.

The result of this experiment was transmitted to Napoleon on the 19th March, 1811, and by his order rendered public; and though the birth of his son took place on the 21st of this same month, on the 25th following appeared the decree, a copy of which is among the subjoined documents. By this decree, as you will perceive, he created six experimental factories for the manufacturing of sugar; he appointed me the director of one of them, which factory he gave to me in property, as a reward for my labor, and for having (*perfectionne*) improved the process for obtaining the sugar of beet. Such was my zeal, that my factory in the fall of 1813 was prepared, and all the beet raised by me, or contracted for, so as to produce 1500 lbs. a day of brown sugar, and the same refined. The first entry of the allies into France caused the total ruin of my establishment. Up to 1816 political events were unfavorable for sugar making, but from that year this manufacture was resumed, and has since never ceased to increase and improve; it is now computed that over 300 such manufactories exist, producing together yearly about from 18 to 20 millions of pounds of brown sugar.

Now, sir, since the making of sugar of beet begins to attract the attention of some agriculturists of the country, I deem it of interest for them, and to gratify the curiosity of others, here to state what were the calculations made in France in 1832, (the latest date of my information,) and add a few observations respecting the benefits one may derive by the mere culture of beets in this country. It is generally admitted, viz:

That one ton, (2000 lbs.) of beet delivered at the factory, costs	$3
That the expenses to work one ton of beet for obtaining its sugar, amount	4
That 2000 lbs. beets will yield 100 lbs. brown sugar, costing	$7

Thus one pound of brown sugar, good quality, costs 7 cents.

By a comparison of the expenses of culture in various parts of France, and on various soils and situations, the average expenses of cultivating there the extent of an American acre of land, are as follows:—Rent and taxes, $5 00; ploughing and harrowing, $2 88: manure, $1 93; sowing, 50 cents; weeding and hoeing, $2 40; gathering, $1 60; carting, $2 56; farmer's profit, $4. Making a total of $21 47.

The produce varies according to the quality of the soil, the quantity of manure used, and the care bestowed on the culture—as we have taken the average of the expenses, so we must take the average of the produce, which is of 7 tons. Some lands yield as much as 15 tons.

The four dollars profit the French farmer derives from this culture, on every acre, is far from being the only one; the others are,

1st. The good state in which the field is left after gathering the beets—no further manure being wanted for the succeeding crop, which crop experience has proved to be always more abundant and of a better quality when succeeding the culture of beets, owing to the destruction of the noxious weeds removed by weeding the beets when young, and prevented from growing, by the thick foliage of the beet when strong.

2d. The facility afforded the cultivator to apply to the culture of beet lands, which he formerly let lie fallow, and consequently, without any additional expenses of rent and taxes, deriving as good a revenue from this land as from any other producing the most.

3d. The advantages the cultivator derives by the purchase from the manufacturer of the pumice of beet at a price not higher than beets, when experience has proved this pumice is worth for him fifty per cent. more; for in fact it is after all but beet deprived of two thirds of water, and consequently a more nourishing food for his cat-

tle, perfectly fitted for fattening them, producing wonders in that respect, which could not be expected from beets in their natural state.

The following is a statement of the receipt and expenditure of a sugar establishment, as reported to the Society for the Encouragement of Manufactures in France. The whole work was performed in 91 days.

Purchase of 500 tons of beet, delivered at $3 20,		$1600 00
1638 days work of men, at 20s., 455 do. of women, at 12s., 364 do. of children, at 5s.,		400 40
For extra working during the night,		109 20
40 cubic feet wood for fuel daily, (28 cords 3-100 at $16 7-100 per cord,)		473 20
Sundry materials for manufacturing purposes,		813 60
Food for 18 oxen used in the mill,		163 60
Interest on $3000 at 15 per cent. for wear and tear,		450 00
Rent for buildings,		120 00
Total,		4130 00
Deduct for molasses sold for	$320	
125 tons pumice at $3 20,	400	
Value of some materials left,	30	750
Produce of 50,000 lbs. brown sugar at 6 7-10 cents,		$3380 00
Sale of 36,000 lbs. 1st quality, at 15 cents,	$5400	
Sale of 14,000 2nd quality, at 10 cents,	1400	6800
Profit,		$3420 00

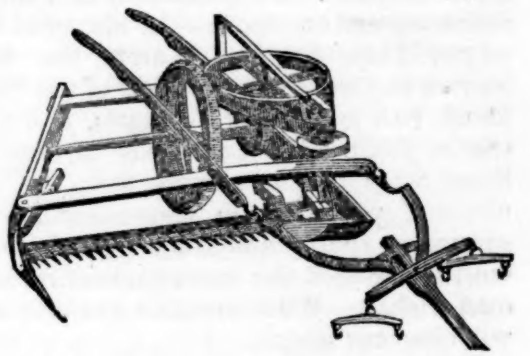
Should this notice be favorably received, I have at your disposal a few particulars respecting the cultivation of beets.

I am respectfully, sir,
your most obd't. serv't.,
MAX'N ISNARD.
French Vice Consul for Boston.

From the Cultivator.

AMBLERS' MOWING MACHINE.

Annexed we give the drawing of a mowing machine, which has been recommended to our notice, but which we have not seen in operation. The grass is cut by a scythe extending along above the teeth or comb, 6½ feet long, which has an alternate movement to the right and left when the machine is in motion. It cuts a swath 5 ft. wide, and about an inch and a half above the



surface of the ground. The grass is left upright where it grew, which facilitates its drying, and saves the labor of spreading; and it is said the machine can be used upon all surfaces where the revolving horse rake can be used. It is furnished with three spare scythes, which may be shifted at pleasure in two minutes. About 100 acres of grass were cut with the model machine last season, in Columbia county, and at the rate, it is stated, of an acre in two hours. The machine is drawn by two horses, which travel on the mown grass. The price is from $60 to $70. Any further information may be had by addressing Messrs. Beale & Griswold, Spencertown, Columbia county, who are the proprietors of the patent right in the counties east of the Hudson, including Long Island, and in Massachusetts and Connecticut. Gentlemen, in whose opinions we repose confidence, assure us, that the machine is a valuable acquisition to our husbandry.

THE POOR BOY.—We delight to trace the progress of genius, talent, and industry, in humble life. We dwell with pleasing emotion on the character and conduct of individuals who, from a 'low estate' of obscurity and poverty, have raised themselves by their own native energy, to affluence and stations of respectability and renown. Our country is full of examples of this description. They fall under our observation every day. Gideon Lee was once a poor boy, and in the occupation of a farmer. He is now in affluent circumstances—recently Mayor of New-York, and at present a member of Congress.—Charles Wells, late Mayor of Boston, was a journeyman mason. Samuel T. Armstrong, the acting Governor of Massachusetts, and at the head of several philanthropic institutions, was once a journeyman printer. There are those living, who recollect George Tibbets, a day laborer, and

know him now as a gentleman of wealth, influence, and enterprise—the Mayor of the city of Troy, Stephen Warren, the well known and esteemed President of the Troy Bank, rich in this world's goods, and rich too, in public spirit and deeds of benevolence, came from an obscure town in Connecticut, pennyless—a shoemaker. Perseverance, energy and industry, and moral worth, produced this consummation of human wishes. With one more example we will close our sketch.

Thirteen years since, a poor boy, 'hired himself' to the captain of one of the steamboats on Lake Champlain, in some humble occupation. Few know the temptations to which young men are liable in the mixed, irregular company of a steamboat —surrounded by evil company, and under equally bad influences. But the poor boy had a talisman to keep him from falling.— He recollected that there was one human being who relied on and cared for him.— 'He was the only son of his mother, and she was a widow.' He faithfully discharged his humble duties. His conduct was marked by those who passed that way, and by his employers. Aspiring for what he merited, he gradually reached the top of his profession. He commanded one of the first steamboats on the Lake. His uniform politeness and attention to those who were necessarily thrown in his way, commanded for him universal respect and esteem.— His reputation reached the ears of the greatest steamboat associations in the world; and many who knew him when a boy on the Lake, now see him at the head of the most splendid boat that foams and dashes through the waters of the noble north, and from a salary of $5 per month, his pay increased to $1500 per annum.

Thirteen years have not altered the good principles of his youth; he still retains that simplicity and purity of character which must ever be regarded as the true nobility of human nature.—[N. Y. Messenger.]

Report on Cotton.—A very valuable report has been made by the Secretary of the Treasury on the cultivation, manufacture, and foreign trade of Cotton, which comprises a mass of information which is not less interesting than valuable. From a table in this report we learn that in 1791 the capital employed in connexion with the growing of cotton in the United States, was 3½ millions of dollars; in Brazil, 33 millions. Ten years after, the capital employed in the United States, was 80 millions; in Brazil, 50 millions. In 1811, capital employed in the United States, 134 millions; Brazil 58 millions. In 1821, capital employed, United States, 300 millions; Brazil, 83 millions. In 1831, capital employed, United States, 650 millions; Brazil, 58 millions. In 1835, capital employed, United States, 800 millions; Brazil 50 million.

The following table, which we extract from the report, shows the items which make up the capital employed :—

1st. The capital invested in cotton lands under cultivation, at two million acres, and worth, cleared, on an average, $20 per acre, is	$40,000,000
The capital in field hands, and in other lands, stock, labor, &c., to feed and clothe them, at $100 per year, on 340,000 in number, would require the interest or income of a capital, at six per cent., of	544,000,000
The maintenance of 340,000 more assistants, &c., at $30 each per year, would require the income of a capital, at six per cent., of	167,000,000
The capital to supply enough interest or income to pay for tools, horses for ploughing, cotton, taxes, medicines, overseers, &c., at $30, for the first 340,000, would be	167,000,000
Making in all a permanent capital , if so used, equal to	$918,000,000
2d. The capital in cotton lands, as stated above,	$40,000,000
Capital in the purchase of 340,000 field hands, at $800 each, on an average,	272,000,000
Capital in the other 340,000 to aid, and to raise food, clothing, &c., at half price,	136,000,000
Capital in horses, cattle, sheep, utensils, &c., for plantation about $30 to each person, to aid in making food and clothing, &.,	20,400,000
Capital in other lands to support stock, raise corn, &c., at 20 acres to each of the 680,000, worth $20 per acre, cleared,	272,000,000
Capital, temporary, or floating, to buy clothing not made on plantation, pay taxes, over-	

seers, freight, tools for cotton, &c., $45 each, to	30,600 000
	$771,000,000

4. The number of persons is computed on similar data and principles to those suggested in the first mode of estimating the capital. Some allowances are made in certain cases, but for comparison there have been preserved similar proportions in all the years for which the computation is carried out in the table.

Thus, two millions of acres, at one field hand to every six acres, would require about 340,000 laborers; but many compute that the number in the United States is over 550,000, who are chiefly, though not entirely, engaged in field labor. Suppose the whole number to be double the field hands, as above computed, or 680,000, who are engaged in field labor, picking and otherwise assisting in the cultivation of cotton and corn, and the estimate of laborers is complete at about 680,000. But allowing that a number more should be added, who are connected with the cultivators, as infirm women, very young children, and too aged persons, &c. unable to labor in the field, besides overseers, owners and their respective families, dependent on the cotton crop, and it is presumed that then a million of persons would be considered as now engaged in the United States, directly and indirectly, in the growing of cotton; but the actual laborers are only about two thirds of that number.

The Roads in England.—There is hardly any thing, perhaps, which at first gives more pleasure to an American traveller than the Roads in England. They have not near so many as we have, especially in some parts of New-England, where every man wants his own separate path to go in; but they are unspeakably better. Within the last few years, all the great roads throughout the kigdom have been thoroughly *McAdamized:* and they are, in more senses than one, 'Royal Highways.' They are very wide, almost perfectly hard, and as smooth as any graveled walk in the gentleman's pleasure grounds. Where there are hills, they are brought down, if possible, to a very small angle, or avoided, by turning a little to the right or to the left—our oldest brethren having found out, sometime ago, it would seem, that it is as far over an orange as around it. Men are kept constantly at work on these roads, breaking up stones for repairs, filling every little rut and depression as soon as it appears, picking up whatever may happen to lie upon the surface, and smoothing down the thin covering of earth which is spread over the solid basis. So perfect are these great thoroughfares, in winter and in summer, that you can calculate, with more certainty, at what time the Royal mail, from London, will reach the remotest towns in the island. A gentleman in Liverpool assures me, that there is scarce five minutes variation, in the time of its arrival there, (a distance of more than 200 miles.) from one end of the year to the other.—[President Humphry's Tour.]

Why do we not have such roads in this country? It is time; labor is not quite so cheap as in England, but the immense advantage to be obtained will, in many cases, warrant a considerable expenditure.

The useless multiplicity of our roads is certainly against us, as it is not possible to keep them all in tolerable repair, while a smaller number could be perfect.

Our roads, too, are laid out in such strange directions, particularly in the older settlements, as there the first path a man made was to his neighbor's house, and then to different parts of his farm, as his woods, springs, &c. These, in many instances, were the embryo of future highways.

It does seem, too, as if our ancestors went out of their way to go over a hill, at least no other rule can be discovered as having dictated the location of sundry roads, the remembrance of which is associated, in our minds at least, with ribs broken and shoulders dislocated.

When we read the following paragraph in the Winchester Republican, we waxed wroth, and if such punishment were in the code, the law should read as follows: "*Be it enacted*, &c.—and if such person be *free* or *slave*, he, she, or they shall be handed over to the persons, the lives of whom have there, then, and thus been jeopardized and endangered, to be Lynched without benefit of clergy.

A slight accident which happened on the Railroad a few days since, caused by the villany of some persons, who have as yet escaped detection, has induced us to copy the following law passed by the Legislature in relation to such acts, and we have also been requested to state that the Company

are determined to prosecute all offenders to the utmost extent of the law:

"*Be it enacted*, That, if any person or persons shall wilfully and maliciously remove or disturb any of the Company's constructions, and place designedly, and with evil intent, any obstruction on the line of the Railroad, so as to jeopardize the safety and endanger the lives of persons travelling the same, such person or persons so offending shall be deemed to be guilty of a high crime and misdemeanor; and if such person or persons be free, he, she, or they shall be adjudged, on conviction, to be imprisoned in the common jail and penitentiary house for a term not less than two, nor more than five years; and if such person or persons be a slave or slaves, he, she, or they shall suffer death without benefit of clergy."

It appears that suspension bridges are in process of construction by companies, not only over the principal rivers of France, but also over the secondary streams. One of the most useful, is that which has just been thrown over the Aisne at Chosy au Bar, near the confluence of that river with the Oise. It consists of a single suspension, resting upon four pyramidal masses of masonry.

From the Edinburgh Quarterly Journal of Agriculture.

EAST INDIA AND AMERICAN COTTON.

The growth of cotton might be much increased in India. There are ten distinct *species* of this plant known, of which there are many *varieties*. Of these species, two, the *Gossypium indicum* and *G. arboreum*, are natives of India. The cotton wool imported from India does not bear so high a character in the British market as the American. The American cotton plant is the *Gossypium herbaceum*; but the inferiority of Indian cotton wool, arises not so much from the difference of the species, as from the mode of managing and gathering the crop. In America the cotton wool is gathered carefully by the hand from the pods as it ripens, and placed in bags suspended from the necks of the gatherers. The locks of wool which fall on the ground, are gathered and kept separate from the rest. *The Indian cotton is gathered all at once*, whether it is thoroughly ripined or not; and it is thrown on the ground to dry and won. The mixture of the earth and brittle pods with the cotton, by this excessive carelessness, renders it dirty and unfit for the delicate machines of this country. The imports of this article into Britain will show the superiority which the Americans at present maintain over our Indian brethren. The quantity of American cotton spun in 1832, amounted to 212,313,696 lbs. whilst the East Indian of the same year only amounted to 18,287,280 lbs. The total import of cotton in 1832 was 270,690,000 lbs., of which 229,007,272 lbs. came from America.

RAILWAY TRANSIT.—It would require 12 stage coaches, carrying fifteen passengers each, and 1200 horses to take 180 passengers 240 miles in twenty-four hours, at the rate of 10 miles an hour. One locomotive steam engine will take that number, and go two trips in the same time, consequently will do the work of 2400 horses! Again, it would require thirty mail coaches (six passengers each.) and 3000 horses, to take 180 passengers and mail, 240 miles in twenty-four hours, at the rate of 10 miles an hour. One locomotive steam engine will take that number, and go two trips in the same time, consequently, will do the work of 6000 horses!—[T. M. Hackney.]

SUGAR FROM INDIAN CORN.—M. Pallas lately presented to the Academie des Sciences of Paris a sample of this substance, extracted from the stem of the plant, which has been found to contain nearly 6 per cent. of sirop boiled to 40 degrees, a part of which will not crystalize before fructification; but it condenses and acquires more consistency from that period to the state of complete maturity. The most favorable time to obtain the greatest quantity of sugar, is immediately after the maturity and gathering of the fruit. The matter left after the extraction of the sugar, is capital to feed cattle or to make packing paper.—[London Mechanics' Magazine.]

The inhabitants of Quebec are about petitioning His Majesty to sanction the Maine Railroad Bill, reserved at the close of the last session. His Excellency has promised to forward the petition.

At a meeting of the Committee of the Petitioners on the 7th inst., Mr. Alden, who had been deputed from the Belfast Corporation, after they had accepted their Charter, and organized the Company, was present. He expected to find the Canada Company also in operation. He gave the Committee the "assurance of the strongest desire among the inhabitants of Maine, to open this communication; and at the same time an expression of their readiness to embark their means in either part of the Road. He had no doubt that, if the citizens of Maine itself should not take up all the stock, the capitalists of Boston, New-York, and of the States generally, would do so, and that the investment would be a profitable one."